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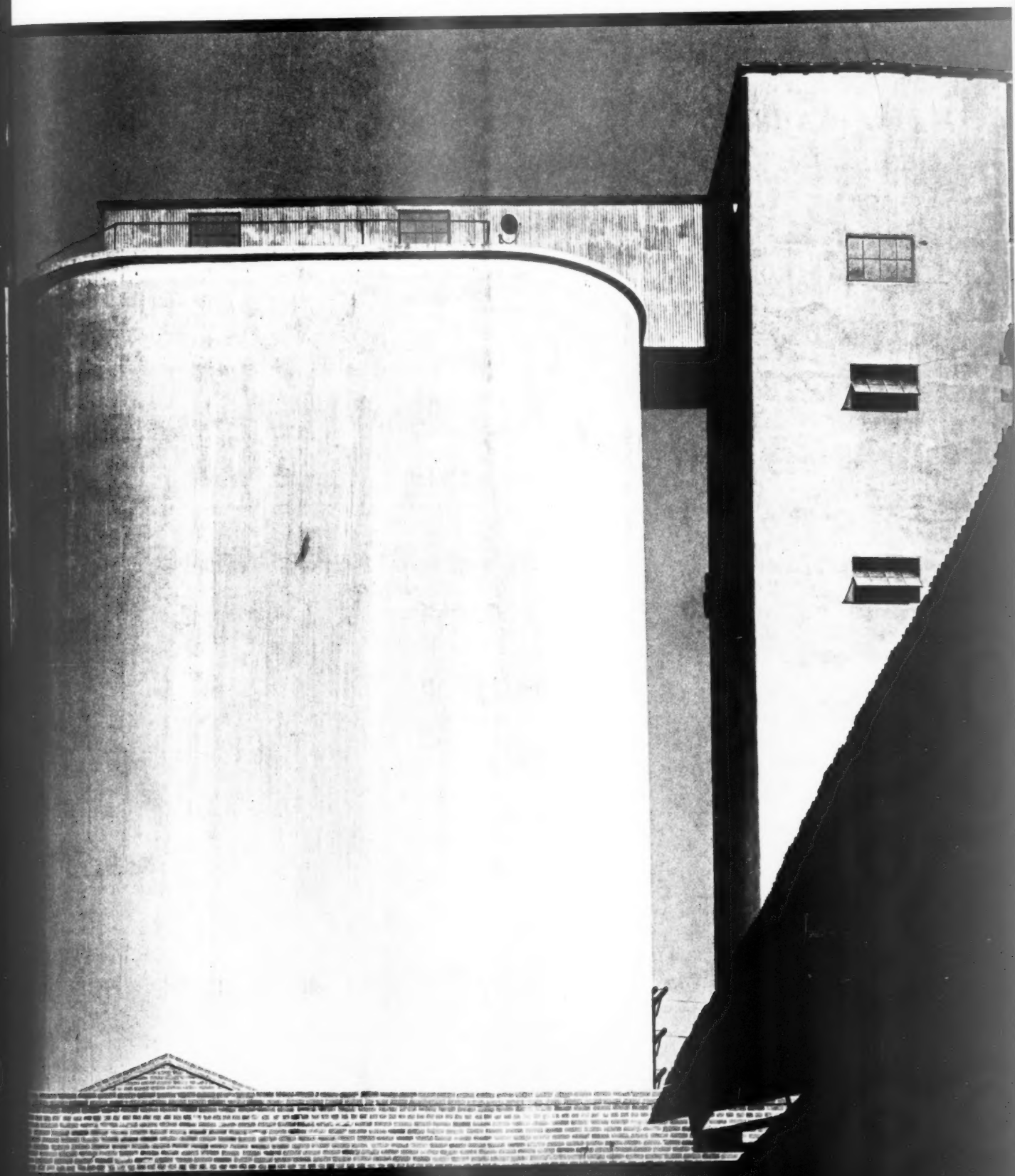

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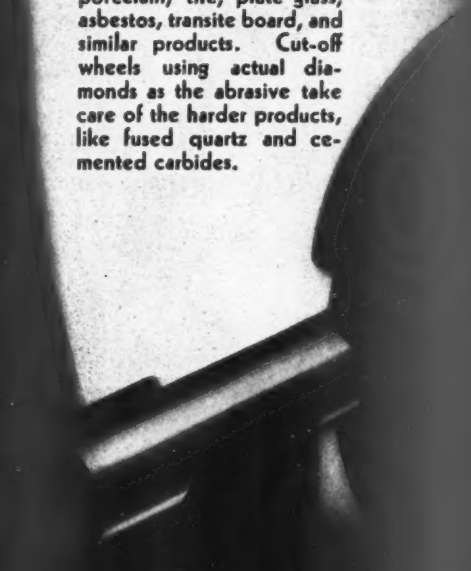

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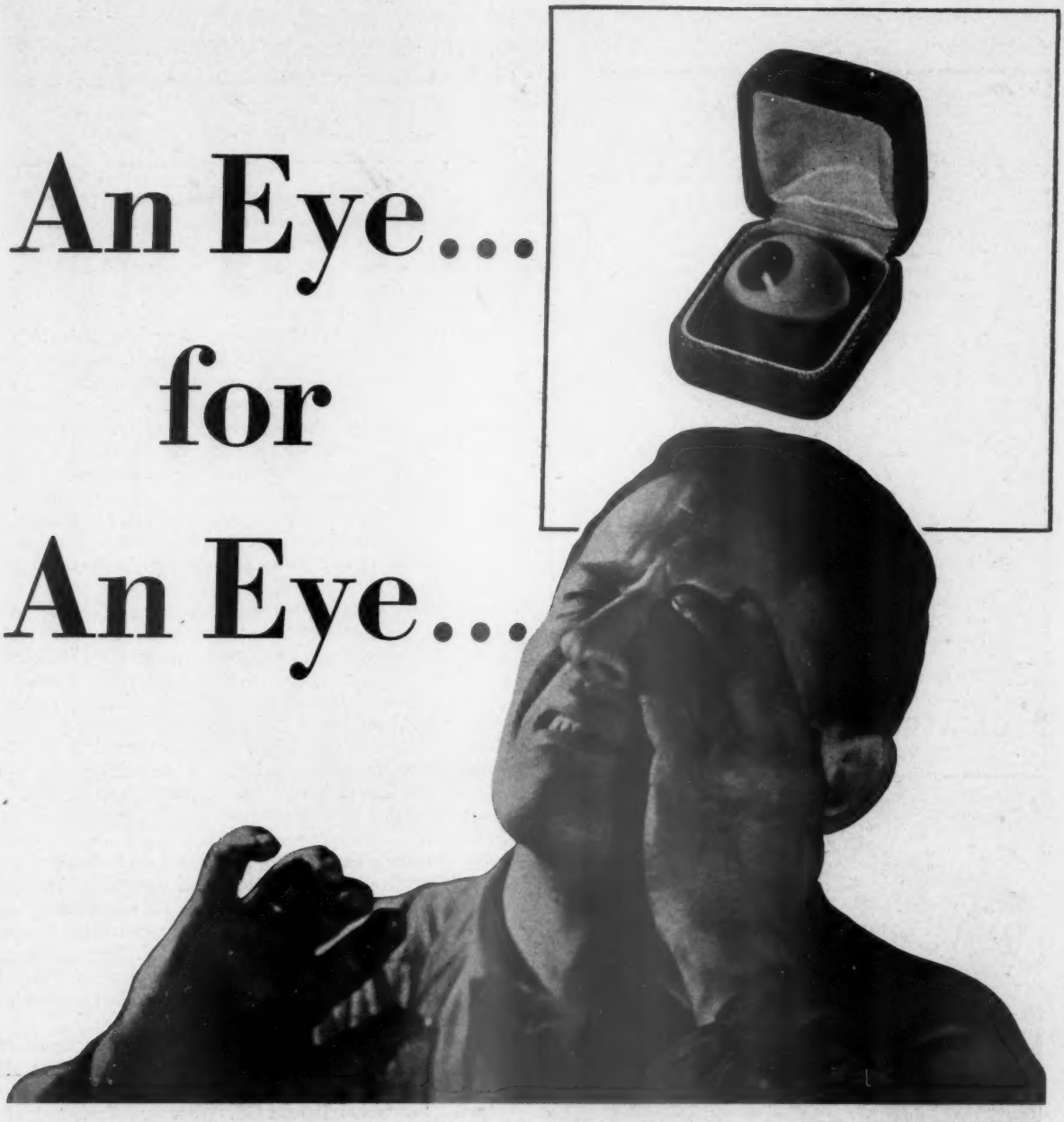

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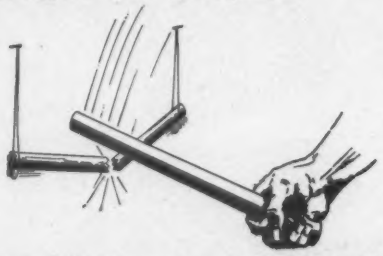

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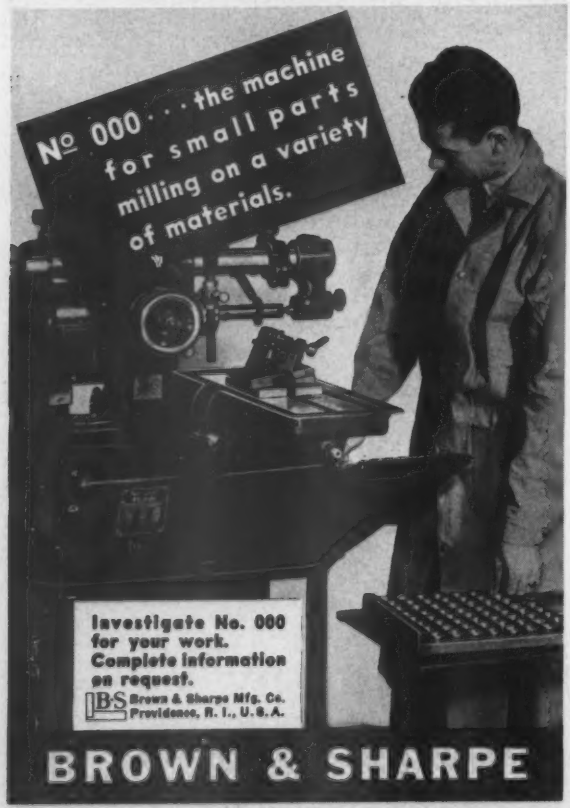
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THE TABULAR VIEW

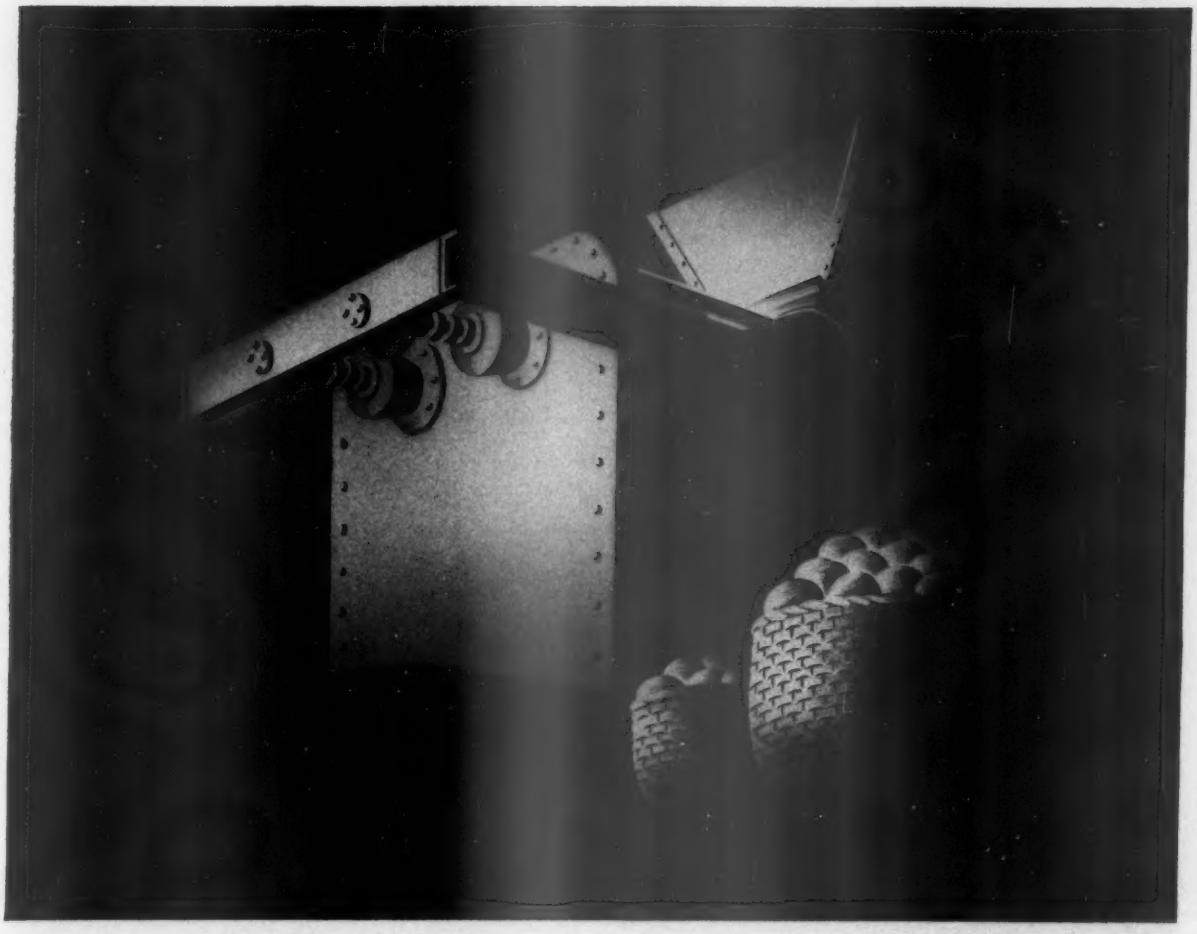
Phoenix? — Cities, it seems, are somewhat reptilian in the tenacity with which they cling to accustomed life. Thus it has eventuated that disasters to cities in the past, which might have been expected to allow for civic regeneration, have usually meant little more than mere resuscitation. Examining the record (page 198), JOHN E. BURCHARD, '23, finds softheartedness and hardheadedness the two chief reasons why rebuilding after a fire, an earthquake, a flood, has generally been rebuilding on the old site, in the old pattern. Several distinguishing factors, however, enter the problem which bombing planes, by destruction of metropolitan areas, are now fashioning for planners. These factors may be expected to contribute to better control when the day of reconstruction arrives. Director of the Albert Farwell Bemis Foundation at Technology, Professor Burchard is an editorial associate of The Review.

Yardstick. — Consumption of energy is clearly a measure of some aspects of a technological culture; production of materials to supply energy may likewise so serve. One such gauge is discussed for The Review (page 201) by PAUL COHEN, '35, Editorial Associate, whose frequent contributions give substance to the Trend of Affairs, and whose article on population and subsistence trends in our last volume will be remembered. Mr. Cohen is with the United Shoe Machinery Corporation.

Streamline Tricycle. — From function to form is the way of sound design; from functionalism to faddism is the fatal flip-flop of unthoughtful designing. Where the limits lie that shall distinguish one from the other is the question attacked in a penetrating essay in this issue (page 204) by ROBERT C. DEAN, '26, a member of the Boston architectural firm of Perry, Shaw and Hepburn, and an instructor in the Institute's School of Architecture.

Positive v. Negative. — Action of democracy against totalitarianism must begin in the mind and soul of democracy itself — in the taking of the moral initiative. Thus holds HENRY M. WRISTON, President of Brown University, in an essay (page 207) drawn from his address before the National Interfraternity Conference. Historian and internationalist, Dr. Wriston is a vigorous thinker on matters educational as well.

New Definition. — Establishment of the humanities in engineering education was important in the pioneering in education begun when William Barton Rogers and his colleagues opened the Institute in 1865. The history of the development of the humanities since then and analysis of the present functioning of humanistic studies at Technology are recounted for The Review (page 210) by ROBERT G. CALDWELL, who, as dean of the Division of Humanities since 1939, has ably clarified and consolidated work in the field. Minister of the United States to Portugal and then to Bolivia, Dr. Caldwell has had an extensive career as student and teacher of history, as diplomat, and as educator.



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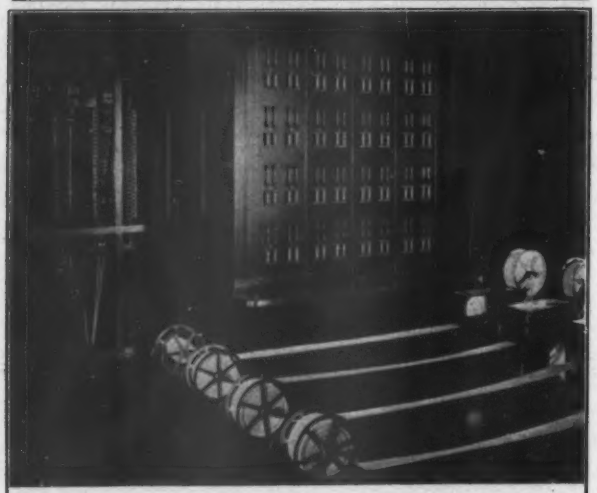

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MAIL RETURNS

What Are the Facts?

FROM ALFRED L. FITCH, '84:

The item on page 149 of the February issue concerning shark-liver oil reminds me of my experience about 1886. With three friends and two other men to operate the whaleboat, I went shark fishing from Nantucket. We caught eight sharks (sand sharks, the men said), and upon our return the fish were taken out onshore. In reply to my question as to what was done with them, one man said, "Make cod-liver oil of them." I never felt sure whether he told the truth or was just joshing, but if the former, the item in The Review does not describe a new practice. I wonder what the facts are.

North Easton, Mass.

The Next Will Soon Appear

FROM ROBERT A. LESHER, '13:

. . . May I commend the Editors of The Review for accepting and publishing Benjamin Lee Whorf's two articles, "Science and Linguistics" (April, 1940) and "Linguistics as an Exact Science" (December, 1940). My evaluation of his contributions is based upon some very recent findings resulting from researches that have been under way for quite a few years. Personally, I am so convinced of the significance of his results that I am actually discontinuing my own investigations for a period sufficient not only to become familiar with the source material of linguistics but also to subject myself to a short, intense training in order to be able to use, with as little error or distortion as possible, the general trends that are finally emerging from this field under Mr. Whorf's touch. His interpretive and integrative point of view in utilizing the inherent nature of language has been long overdue.

I have for some time been familiar with the works of Ogden and Richards, Jespersen, Max Müller, Whitney, Turner, Rozwadowski, and Malinowski, and recently have followed the efforts of Korzybski, Thurman Arnold, and Stuart Chase, '10, to bring the public interest to bear upon the question. Even with this background, I can say sincerely that I hope you can interest Mr. Whorf in making further contributions.

Washington, D. C.

Tossing a Few

FROM LORING C. FARWELL, '37:

With some misgivings because of the choice of subject and the relatively colorless style involved, I am submitting three articles [to be noted in Technology Men in Action in due course. — Ed.] as the work of a member of the Class of 1937. I toss direct apologies to any member of the Class who objects . . . but no others in the Class seem to have cracked through. Maybe this will scare them into it.

At any rate, this letter provides an excuse for tossing a few compliments at the staff of The Review and the authors of its articles. I suppose such praise is old stuff in The Review Office, but I'd like to add the expression of one more graduate who appreciates the style and quality of the writing, the choice of subject, and, above all, the lack of extreme professionalism characterizing the magazine. There are times when the stimulus of information contained in it has almost awakened a latent desire to inquire into those studies which I handled less adequately in the course of my three years in Boston and environs. And that, sirs, is going some! *Ergo*, my compliments and my best wishes.

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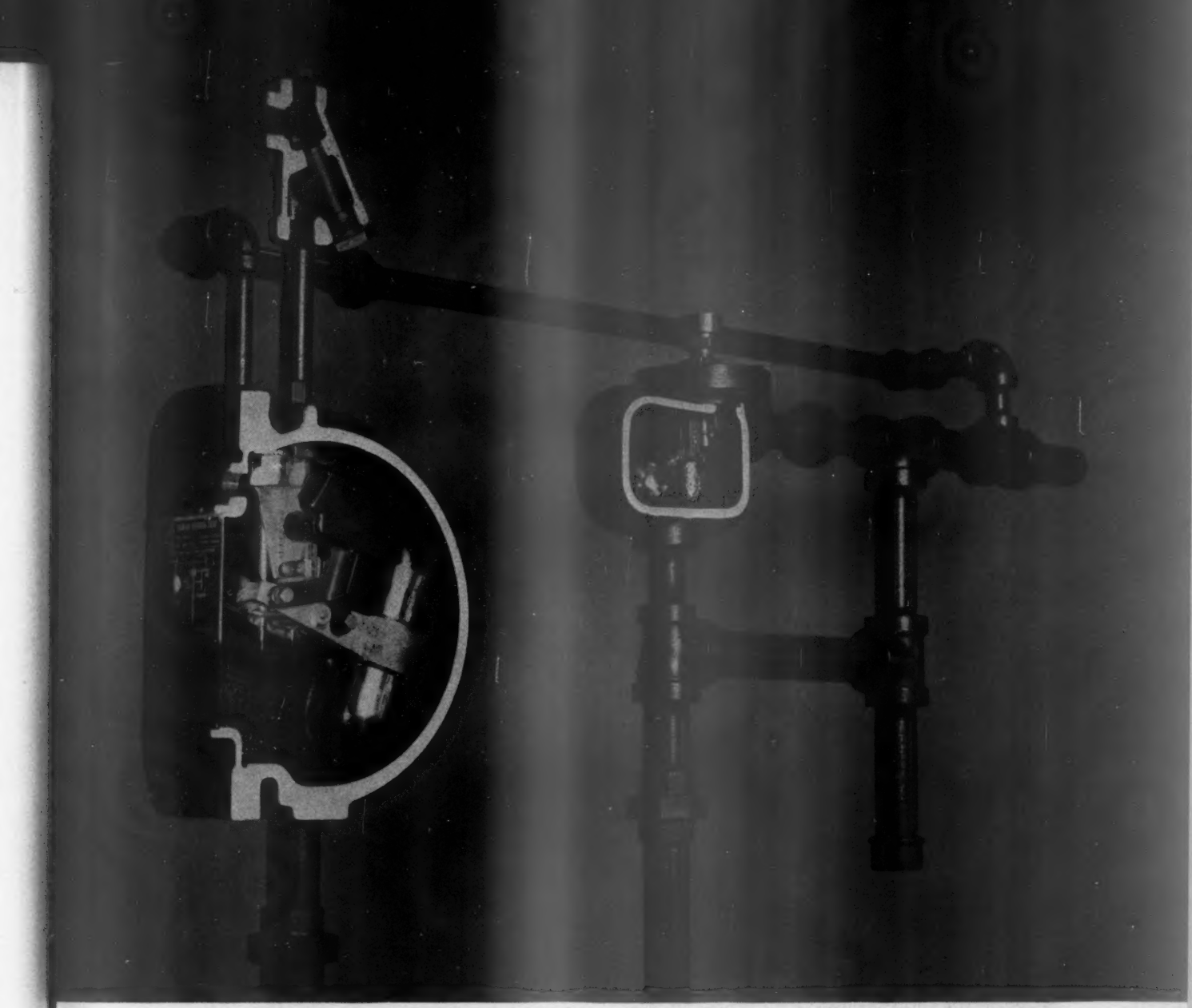

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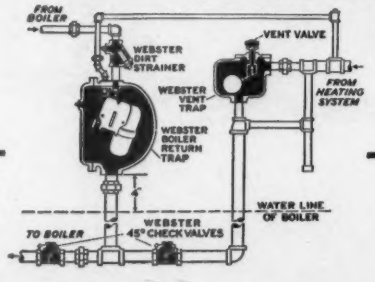

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H. F. MARSHALL '19

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Spahis of the "free French" troops with the British in Libya

VOLUME 43 NUMBER 5

THE TECHNOLOGY REVIEW

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EDITED

AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

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From a photograph by Cushing-Gellatly

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THE
TECHNOLOGY
REVIEW

Vol. 43, No. 5 March, 1941

The Trend of Affairs

Help Yourself

TO the list of places in which the American consumer has the privilege of spending his money is being added the supermarket, symbol of the present trend toward self-service and increasing unit size. Like every trend in retail distribution, this one is important because, out of every dollar the consumer spent in 1929 (and the ratio is much the same today), fifty-nine cents went to cover the costs of getting the goods to him.

Mass production and technical advances in industry have brought about a threefold increase in output per worker during the past seventy years, it is estimated by the Twentieth Century Fund. But mass production demands mass distribution, and mass distribution by this standard has not done so well. Between the 170,000 factories (counting those whose output is worth $5,000 or more a year) and the 130,000,000 people of the United States stand some 175,000 wholesaling agencies and 1,500,000 retailing establishments. All told, half the gainfully employed workers in this country are engaged in one or another phase of distribution or service, and their output per man has not shown any material increase since 1870.

The foregoing figures do not necessarily reflect on the efficiency of the distributive function. Conditions have changed since the miller ground wheat for the local inhabitants. The customer now expects a great deal more service than the bulk of the world's stores have ever offered in the past.

Even prior to the war, most of the world bought in a seller's market, reminded by queues every now and then that demand was pressing on supply and not the reverse. As defense takes up more and more of the capacity of industry, this country may also swing toward such a condition, but for the moment at least, the American consumer remains virtually the sole possessor of the right to pick and choose on a grand scale. Manufacturers still fight for his favors by such devices as rapid changes in style, extensive advertising, and handsome packages; retail stores still grant him credit and delivery and return privileges as well as other inducements.

In all probability, the costs of distribution would be higher were it not for the many innovations which have been continuously changing wholesaling and retailing methods. The past eighty years have seen the rise of the chain store (the Great Atlantic and Pacific Tea Company got under way in 1858), the department store, and the mail-order house. All have given to retailing the advantages of able, specialized management and the ability to buy in large quantities — characteristics which appear to be notoriously absent from the field as a whole. Only 8 per cent of retail stores are members of chain organizations, but this 8 per cent does 23 per cent of the business. The remaining retailers are independents, most of them with yearly gross so small that their net incomes are near the disappearance level.

Against this background, a slow but steady trend toward mass distribution in the retail field has been visible for the past decade. Particularly in the grocery business, the smallest stores, which have the highest mortality rates, appear to be giving way to larger, departmentalized units which are not so apt to grant credit or delivery service and are more apt to ask the customer to help himself. As defense work makes greater demands on the labor market, the trend toward self-service should accelerate. Customers seem to feel that they are adequately recompensed, however, by the lower prices which usually prevail at such stores. Chain groceries, for

◀ *Tower of the Olympic Stadium at Helsingfors, Finland, photographed in August, 1939, by B. W. Irvin, Jr., '38, who utilized his traveling fellowship in architecture in 1938–1939 in a tour of photographic study of architectural subjects. Other examples from his collection are on pages 196 and 197 of this issue of The Review; still others are to appear later.*

Wesley Bowman

One of the largest steam shovels in the world, used for clearing away surface dirt for strip coal-mining

example, with an average gross considerably more than twice that of independents, manage to undersell the latter consistently in spite of taxes which many states levy on chain units.

In unembarrassed coexistence with this trend to larger stores is another toward decentralization of certain retail functions. For some years there has been a drifting of many department stores to the suburbs of the large cities. Although greatly aided, if not made possible, by improvements in urban transportation which permitted the movement of large numbers of people into the shopping areas, the department store must now reckon with the fact that traffic congestion has long since reached the point where greater concentration is discouraged. Regardless of location, department stores have shown considerable progress toward modernized architecture, improved layouts with more of the merchandise on display, and rapid utilization of advances in illumination and air conditioning.

The store which exhibits many of the foregoing trends in their extreme form is that hardy flower of the depression, the supermarket. Defined by the Super Market Institute as a departmentalized cash-and-carry store with a minimum floor space of 5,000 square feet, a yearly gross that exceeds $250,000, and at least one self-service department, this type of store is now estimated to handle perhaps 20 per cent of the huge retail grocery business. One commentator has noted that, with the best sites for such stores already well developed (more than 7,500 are believed to be in operation), further expansion should be in the direction of smaller, neighborhood supermarkets — almost a contradiction in terms. Attracting their customers with low prices, a tremendous array of a wide variety of goods, and very often free parking facilities, these stores are showing a tendency to handle commodities quite foreign to the grocery field: Many have drug and cosmetic counters, automobile tires are not unknown, and one enterprising merchant reports good results from a self-service liquor department.

Another Coming of Age

ON more than literary grounds can we speak of infant, adult, or senile industries. Most of the products on which industries are based can be shown eventually to follow a pattern of rapid initial development, stability, and finally — if no drastic innovations appear to give them renewed vigor — eclipse, as more potent competing devices develop. The transport airplane, only yesterday indisputably an infant prodigy, is well through its period of rapid advance in basic performance, according to Edmund T. Allen, '23, director of aerodynamics and flight research for the Boeing Aircraft Company, writing in the *Transactions* of the American Society of Mechanical Engineers; more and more attention is centering on improvements which are primarily refinements of accepted structures.

Although not all the speed inherent in flight at higher altitudes has been exploited, the speed at which transport planes travel is showing a tendency to increase more slowly. The same condition obtains in economy of operation and even in the size of such planes. The amount of work required at cruising speeds per ton-mile of pay load, a fundamental measure of plane performance, is leveling out. Obsolescence is slower, and the construction of new models for the air lines is taking enormously more time and money than was true in the early days of the industry. Emphasizing Mr. Allen's conclusions is the trend of airplane motor design, which appears to be approaching rock bottom at about one pound per horsepower. The new 2,000-horsepower engines have no better horsepower-weight ratios than do their 1,000-horsepower brothers.

On the other hand, changes concerned with the reliability of airplane performance, with safety, and with the comfort of passengers are occurring rapidly. Because air lines have found that traffic volume responds strongly to increases in passenger comfort, the weight of luxury items — space per passenger, food service, air conditioning, and related matters — has grown from 10 pounds a passenger in 1930 to about 180 pounds in 1939.

Both the automobile and the locomotive had similar early histories. Daimler patented the high-speed internal-combustion engine in 1885–1886, and by 1894 Krebs had designed the Panhard car which, with its vertical in-line engine under a hood at the front of the car, a clutch behind the engine, a sliding-gear transmission, differential gears, and so on, had most of the basic

features of the present automobile. By about 1910 (Ford began manufacture of the Model T in 1909) the automobile was a vehicle capable of successful and economical operation.

As for the locomotive, Trevithick's crude device of 1803–1804 was followed in 1829 by Stephenson's *Rocket*, which had most of the basic elements now associated with the steam locomotive. The *North Star*, built in England in 1846, was recognizable, even in its outward appearance, as the direct ancestor of the present rail giants. Furthermore, and these facts occasion considerable respect, it reached a speed of 78 miles an hour and averaged 2.5 pounds of coal per horsepower hour. Present engines don't do much better. It is interesting that about the only notable change in locomotives during the second half of the Nineteenth Century was in size. The Westinghouse brake, demonstrated in 1868, was concerned with safety, not with engineering performance.

How Many?

POINTING out parallels among census figures is dangerous business if the pointer undertakes to suggest cause-and-effect relationships on the basis of the figures alone. Yet few diversions of the quidnunc variety are more engrossing or more widespread than the citing of variegated and often unrelated statistics, which are made interesting and alive just because they are mentioned together. With this implied caveat in mind, here are a few numerical items which the news has turned up during these recent weeks.

The horse, according to the first eight states reporting in the 1940 census of agriculture, isn't what he used to be, statistically,— in fact, he has been steadily getting less so. From 1930 to 1940 the total decline in the number of farm horses in the eight states was 384,458. Home state of man's equine ally, Iowa, accounted for 312,266 of the missing steeds, the drop being from 1,040,479 in 1930 to 728,213 in 1940. Home state of the automobile, Michigan, saw a drop of 36,882, from 381,357 in 1930 to 344,475 in 1940. In 1915 the number of horses on farms in the United States was nearly 22,000,000. This had dropped to less than 15,000,000 by 1930.

In 1915 the automobile industry of the United States produced a total of 969,930 passenger cars and trucks. The total for 1940, according to preliminary statistics of the industry released by the Automobile Manufacturers Association, was 4,476,000, which compares with 3,510,178 for 1930 and has been exceeded only in 1929 and 1937. Factory sales for 1940 are listed as 25 per cent ahead of those for 1939.

The Bureau of the Census reports that on April 1, urban population of the United States numbered 74,423,702. This figure represents an increase of 5,468,879 or 7.9 per cent over 1930. Rural population increased 3,425,350 to 57,245,573 during the decade. The gain in rural population was 6.4 per cent. Lest one should con-

Paul J. Woolf

Photographic trickery is all too easily overworked, but occasionally, as in this shot of a Surrealistic bedroom, turns out to offer interesting contrasts between the appearance and the reality.

clude that all the talk about "back to the soil" was utterly meaningless, it should be observed that the rate of increase of the urban section of the population was slowed considerably in the decade. In 1910, 45.8 per cent of the total United States population was urban; in 1920, 51.4; in 1930, 56.2. The 1940 figures show 56.5 per cent urban.

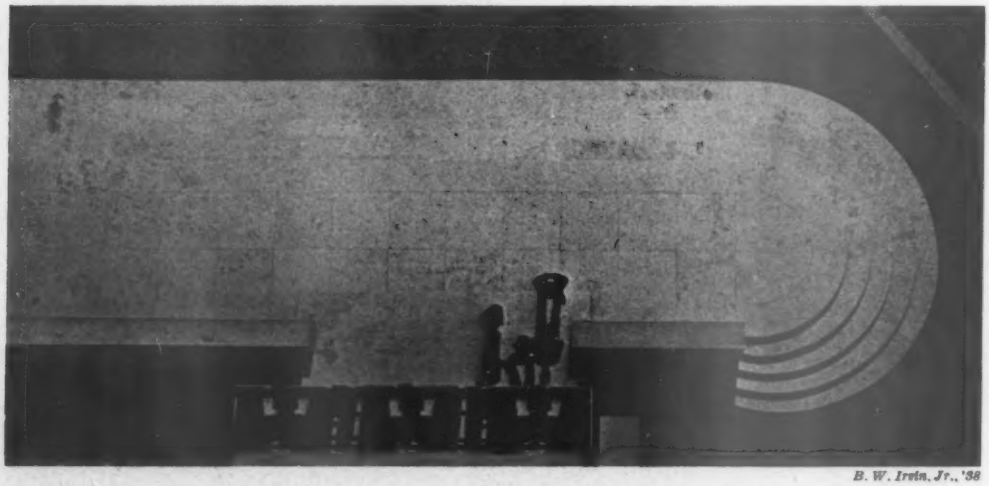
Sound Drinkers

SOUNDPROOFING can defeat its own purpose if it is not properly done, results of Institute research into the problems of room acoustics demonstrate. Install a very soft ceiling covering in a room, with no absorptive material elsewhere, and the ceiling will absorb so well that it pushes the sound waves away from itself, to rattle between the hard walls. If the absorptive material is too soft and is all concentrated in one section of the room, results will be poor. Properly placed, however, absorptive material will literally "suck in" sound waves to such an extent that it can absorb half as much again of sound energy as would naturally fall upon it. Absorption coefficients of 150 per cent may thus be attained. A coefficient of 100 per cent is recorded when a unit area of absorptive material takes up the whole amount of sound energy which would normally impinge upon it if a uniform distribution of the energy is assumed. Measurement shows, however, that absorbers properly placed not only drink up the normal amount of energy but are thirsty enough to consume an additional 50 per cent.

These generalizations are based on investigation of acoustic phenomena which have busied Philip M. Morse, Professor of Physics, and Richard D. Fay, '17, Associate Professor of Electrical Communications, during the past two years. Setting out to survey the whole field of noise and noise absorption in rooms, the Institute researchers, working at times with investigators at Harvard, first recast the classical theory of Sabine through the use of modern theoretical and experimental techniques. As originally stated in 1900 on the basis of his studies at Harvard, Sabine's theory had worked with entire satisfaction for experiments with less refined equipment, but the development of more delicate instruments had necessitated a rechecking of the theory in order to bring it into line with experimental results. The question of the reaction of absorptive material upon the distribution of sound in the room, for one thing, had not been reckoned with in the earlier work. Readers of Professor Morse's article in The Review for last November will recall the history of the Sabine experiments.

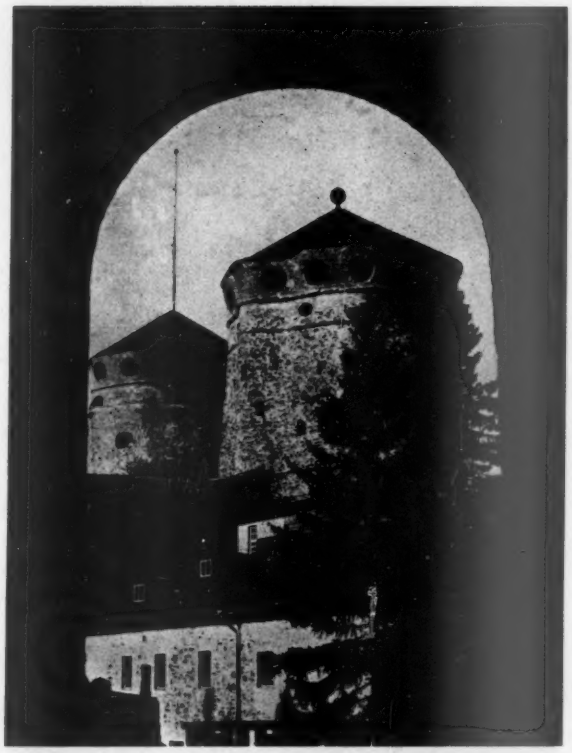
As it has been re-worked, the theory now permits derivation of curves for the acoustical properties of a material as a function of the frequency of incident sound waves. The dependability of the theory is well illustrated in the fact that when a set of such curves was worked out by Professor Morse at the Institute and the properties of the same material were experimentally determined by Dr. L. L. Beranek at Harvard without reference to the curves, the two sets of results were in agreement. Porousness, resistance within the pores, effective density of the air, and the presence of loose material in the pores are the constants defining the properties of a material; from them it is possible to ascertain how much sound the material will absorb. Attainment of this degree of control of theory now permits consideration of the possibility of designing an ideal absorber. Knowledge of the transmission of sound energy into a material can lead to knowledge of transmission through the material; hence by lamination of materials the investigators hope to enable the development of absorbers "tailor made" in such fashion as to meet directly the specific needs imposed by given installations.

One practical application of the results of Professor Morse's theoretical and Professor Fay's experimental studies is in the room at Technology which houses the generators supplying electricity to the supermagnets of Francis Bitter, Associate Professor of the Physics of Metals. When the generators first went into action, noise poured out of the room through air ducts installed to bring in air for ventilation, and with considerable disturbance to adjoining lecturers. After a study of the situation, the investigators decided to install honeycombed ducts to trap noise which, traveling outward along the center of the ducts, had avoided absorption in the walls. In addition, special laminated sound-absorbing material was placed around the generators themselves to absorb the sound as soon as it was generated.



B. W. Irvin, Jr., '38

Abstract design in a straight-down view of the entrance to an elementary school in Rome



Towers and arches compel the photographer anywhere. At the left is Olaf's Castle at Savonlinna, Finland; at the right, the Piazza S. Francesco at Assisi, Italy. These photographs were among hundreds taken by B. W. Irvin, Jr., '38, who as traveling fellow in architecture in 1938–1939 made a tour of photographic study of architectural subjects.

By this means, sufficient ventilation is provided, but the noise level is cut down so that ordinary conversation can now be carried on in the control room next to the generators. Where previously lecturers in near-by classrooms were drowned out, now it is difficult to know when the generators are turned on.

The problem involved here is one of considerable importance in aviation and in architecture as well. In airplanes, ventilation necessitates intake ducts from the outside, and since even a very small uninsulated hole can let in a great deal of sound energy and overload the absorptive powers of usual cabin-wall insulation, means of insulating the ducts to bar sound out are desirable. Similarly, ways of preventing cross talk from room to room in a building via air ducts are of value.

In settling these problems, the cross section of the duct and the placing of the absorptive material are of importance. Both of these requisites are clarified by the theory resulting from the Institute work.

Horse without Breath

FIERY breath is a time-honored attribute of the iron horse and will doubtless continue to be. Yet steam locomotives without fuel or fire, but with steam "reservoirs," are now performing certain services with greater economy, safety, and convenience than do engines with fired boilers. First conceived over seventy-five years ago and used to some extent in Europe since that time, the "breathless" iron horse has until recent years been almost unknown in the United States, where it has had only occasional applications and has never found widespread use. Now a definite future is seen for fireless steam power, and an early broadening of its field is anticipated. Among present users are the navy yards at Charleston, S. C., and New York City.

The fireless steam locomotive is a very simple machine: It carries a tank of hot water which supplies steam to a conventional engine. No firebox, no fuel, no boiler tubes are required. The tank is charged with steam from a power-plant boiler and provides several hours of normal service before recharging is necessary. The engine, easily operated by one man, is clean and quiet. For certain applications it possesses definite advantages of economy and safety over the steam locomotive with a fired boiler. For example, the fireless locomotive has lower first cost; requires less in repairs and upkeep; makes possible greater economy of fuel, which is burned in a stationary power plant; and has no fire hazard even in flammable atmosphere. While standing, it wastes much less energy than does a fired engine. Limitations in the use of it are the necessity for access to a steam boiler and the fact that only rather short hauls may be undertaken between trips to the boiler. Typical applications are freight switching at industrial plants and coal haulage in mines.

Steam pressure for the fireless locomotive may be almost any amount available, higher pressures permitting greater energy storage. A pressure of 160 pounds a square inch has been used (*Concluded on page 220*)

Sir Thomas Gresham's Picture

As Devastation Stalks through the Cities, Planners Will Find Slight Parallel in the Past; Rebuilding Must Reckon with New Conditions

By John E. Burchard

. . . I went againe to the ruines, for it was now no longer a Citty. . . .— John Evelyn, September 10, 1666.

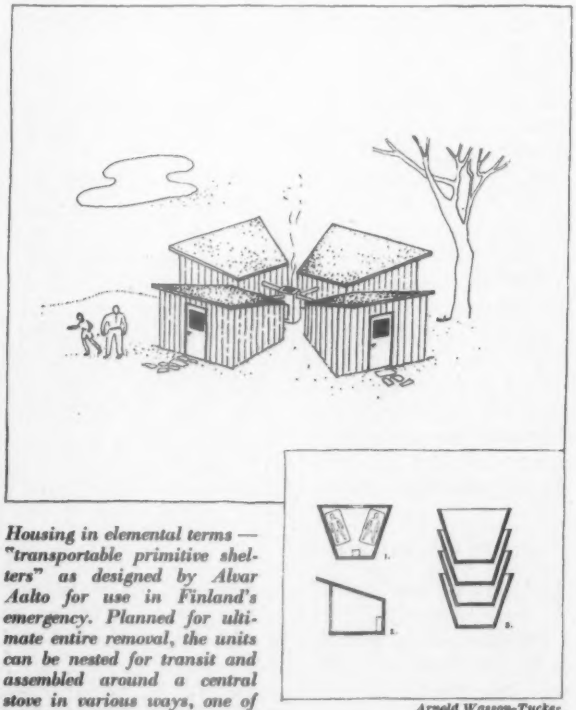
. . . Walked into Moorefields (our feet ready to burn, walking through the towne among the hot coles). . . . The Exchange a sad sight, nothing standing there, of all the statues or pillars, but Sir Thomas Gresham's picture in the corner. . . .— Samuel Pepys, September 5, 1666.

SUPERFICIALLY, London of mid-September, 1666, and London of mid-January, 1941, had much in common. Near the latter date Mollie Panter-Downes could write in the *New Yorker:* ". . . One had to pick one's way over the hoses that lay coiled across the dark little alleys. Some of the fires were still smoking. . . ." Such words might seem to echo those of Evelyn in the earlier time: ". . . Thence thro' Cornehill, &c. with extraordinary difficulty, clambering over heaps of yet smoking rubbish, and frequently mistaking where I was. The ground under my feete so hot, that it even burnt the soles of my shoes. . . . Nor was I yet able to passe through any of the narrower streetes but kept the widest; the ground and aire, smoake and fiery vapour, continu'd so intense that my haire was almost sing'd, and my feete unsufferably surbated. The bie lanes and narrower streetes were quite fill'd up with rubbish, nor could one have possibly knowne where he was, but by the ruines of some Church or Hall, that had some remarkable tower or pinnacle remaining. . . ."

Though, as we shall see, there are noteworthy distinctions to be drawn between the problem set by the early fire and that created by the new forms of devastation, for the moment it will profit to examine more closely the events of 1666. The fire itself might have been stopped much sooner if demolition, which ultimately was used, had been practiced at the beginning. On this point Evelyn remarks: ". . . This some stout seamen propos'd early enough to have sav'd nearly the whole Citty, but this some tenacious and avaritious men, aldermen, &c. would not permitt, because their houses must have ben of the first. . . ." This is probably a fair statement. Evelyn was himself a man of property. The attitude is to be remembered. It has not disappeared. It has affected every effort to improve cities.

Except for sporadic outbursts, the fire, which started on September 2, had stopped by September 6. Four days later, King Charles received Christopher Wren, who by that time had made a plan for rebuilding the city. On September 13, Evelyn presented his plan; on the twentieth, Valentine Knight came forward; on September 21, Robert Hooke. Knight was a soldier. Hooke and Wren were mathematicians, the latter an untraveled architect as well. Evelyn had in 1662 been commissioner for reforming the buildings, ways, streets, and incumbrances, and regulating hackney coaches. He was at the time one of the commissioners for repairing St. Paul's. As town planners, all were but amateurs.

In the light of what ultimately happened, the Wren plan was admirable. It was probably impossible to achieve, for not one building or street was to keep its old place, so that a unification or reparceling of property would have been required — a degree of co-operation which the world has not even yet attained. Evelyn's scheme, more formal, was subject to the same criticism. Professor Hooke's plan has disappeared. Captain Knight, whose plan betrayed no great imagination, did work out financial details, including taxes to support the army. For his pains he landed in jail. Knowing how dangerous the publication of such a proposal would be, the King sequestered the captain instead, protesting in the journals: ". . . As if his Majesty would draw a



Housing in elemental terms — "transportable primitive shelters" as designed by Alvar Aalto for use in Finland's emergency. Planned for ultimate entire removal, the units can be nested for transit and assembled around a central stove in various ways, one of which is sketched. The units are designed to be built of materials locally available. Plan (1), section (2), and method of stacking (3) are also shown.

Arnold Wasson-Tucker

George A. Douglas

This view of the planned community of Radburn, N. J., taken some seven years ago, shows areas then available for further development. The "super blocks" of the plan are clearly shown.

benefit to himself from so public a calamity of his people, of which his Majesty is known to have so deep sense, that he is pleased to seek rather by all means to give them ease under it."

The other planners fared better. Evelyn remained an adviser of the King, while Wren and Hooke were put on the committee for rebuilding London, even after their own plans had been jettisoned. Considering the pressure under which the committee worked, at a time when the city was still in a panic, considering the limitations imposed by property rights, it is probable that they did a good job. In such details as the variation of street widths, in the methods for paying off property owners whose land simply had to be expropriated, the committee showed intelligence and integrity. Yet postfire London was not a workable city.

At the outset such an unsatisfactory result did not seem likely. King Charles had lived long abroad, had admired the monumental capitals of the Continent, was apparently well disposed toward Wren. On September 13, the King published a proclamation which remarked that he personally had suffered more loss than any other owner; that rules could not be laid down for rebuilding, but that premature rebuilding of houses would not do; that building therefore could not be commenced until further instructions issued. Some streets were decreed to be wider than heretofore; there was to be a quay, which was to be zoned against "Brewers, or Diers, or Sugar-Bakers, which Trades by their continual Smoaks contribute very much to the unhealthiness of the adjacent places. . . ."

On the same day, after presenting his plan to the King, Evelyn wrote in his diary: ". . . Whereupon after dinner his Majesty sent for me into the Queen's bed-chamber, her Majesty and the Duke onely being present; they examin'd each particular, and discours'd on them for neere an houre, seeming to be extreamely pleas'd with what I had so early thought on. The Queene was now in her cavalier riding habite, hat and feather, and horseman's coate, going out to take the aire. . . ."

But it was Evelyn who took the air. Even as late as September 27, he could write to Sir Samuel Tuke with some confidence that "they are now busied with adjusting the claimes of each proprietor, that so they may dispose things for the building after the noblest model. . . . And truly there was never a more glorious Phoenix upon Earth, if it do at last emerge out of these cinders, & and as the designe is layd, with the present fervour of the undertakers. . . ." The fervor did not, however, persist. The phoenix, if it emerged at all, had its wings thoroughly clipped by those adroit bird fanciers, the landholders.

The picture of Sir Thomas Gresham, founder of the Royal Exchange, still peers too fiercely from its corner. This story of London states a motif of city building which is as old as the institution of private landownership and which is steadily repeated whenever the occasion arises. It is of great importance that this motif be stilled. The cities of the world stood in 1940 in most precarious position. They were gradually dying in the middle and stretching their decaying hands farther and farther over the surrounding countryside. Students of city planning were in general agreement that self-immolation was only a matter of time unless serious efforts were made to prevent it. A city might well have died without ever feeling the impact of a bomb.

Prior to recent efforts, opportunities have arisen for the creation of cities competent to serve their time. Some of the best of planned cities have been those which have sprung full panoplied from the will of the state. Often they have been capitals — New Delhi or Tel Aviv, adjacent to old towns of the same names; Canberra, raising itself majestically on the solitary Australian plain. Sometimes they have been the result of settlement plans — Littoria, on the reclaimed Pontine marshes; Norris and Boulder City, near great dams. Sometimes they have been erected by industry — Kohler, Wis.; Arvida, Quebec; or Kingsport, Tenn. They may have been residential — Welwyn or Radburn; or completely planned green-belt towns which

observed every principle of good arrangement except those imposed by economics. But all such cities and towns have been largely free from the major handicaps springing from sentiment or greed, free either because the builder obtained the site before the plan was well known or because he had sufficient power after the plan was known to prevent shenanigans by realtors or proprietors.

This has not always been the situation. It will be recalled that Pierre L'Enfant, the hot-tempered planner of Washington, had endless squabbles with the commissioners of the district; that he was accused of holding up plans of the city at the time of the auction because he feared that early purchase of private lands would put difficulties in the way of the execution of his plan; that he personally tore down a house built by Daniel Carroll of Duddington across what was to be New Jersey Avenue. Daniel Carroll (not he of Duddington but the commissioner) wrote to Madison: "The exorbitant and unreasonable expectations of Daniel Carroll of Duddington at one end of the city and Robert Peters at the other, may check in a degree the public good & do prejudice to themselves." Major L'Enfant ultimately had to quit. It is good luck that his plan survived, even though recent years have expanded it with less intelligence.

Sometimes again, leaders of great power have found it possible to free a plan by condemnation. The ancient fortifications served Paris well for its boulevards and Vienna well for its Ringstrasse, though both were ultimately choked up again. Stockholm has gradually acquired title to enough of the land within her city limits so that a good plan can emerge. Free funds, dauntless courage, and ruthless determination have permitted Mayor La Guardia and his brilliant lieutenant, Robert Moses, to move part way in freeing Manhattan from the constricting coils.

But offhand the wholesale destruction of large urban areas seems to proffer the unique opportunity. Hence those who wish to find in the present dark world a ray of hope for the future are tempted to feel that in the present disasters lies not destruction of cities but their ultimate salvation. There is reason for this hope, but let us look first at the obverse of the picture. Previous disasters in their effect on the city are not encouraging. They fall generally under the heading of conflagration, though the fires themselves may have been caused by war (Dresden, Moscow), by earthquake (Yokohama, San Francisco), or by sheer human carelessness (Chicago, London). Conflagrations offer perhaps a poor analogue for the devastation wrought by the bombing plane. This would be true if only because of an intrinsic difference between the kinds of psychic effect produced on the population by each of the catastrophes. The first — fires — are fortuitous, capricious, works of a whimsical devil or an irate God, depending on whether the observer is agnostic or fundamentalist; the second — bombings — are planned works of systematic destruction done by men deliberately, coldly, objectively. Nevertheless, in the absence of any better comparison, it will be useful for us briefly to survey the results which previous major fires had on city plans.

It must be admitted at once that such fires seem to have played no very great role in the history of cities, often going unmentioned. Yet they have been extraordinarily common. Istanbul witnessed eighteen, of which the latest was in 1870. Moscow had six of importance before the classic blaze of 1812. London's historic five culminated with that of 1666, which we have noted. Memel had five also, with the latest in 1854. They have been suffered in Edinburgh, Cork, Paris, Weimar, New York, Pittsburgh, San Francisco, Chicago, Baltimore, Boston, Dresden, Hamburg, Copenhagen, Liverpool, Glasgow, Marseille, Königsberg, Poznan, Tokyo, Yokohama, Manila, Bombay, Leningrad, Stockholm, Bergen, Canton, Cuzco, and Valparaiso. Patriotic citizens of other places may be affronted by this list.

The Chicago fire of 1871 was, save for the San Francisco fire of 1906, the greatest of modern times. Contemporary writers record that "rebuilding began before the cinders were cold," that the business district was rebuilt within a year. The only accomplishment seems to have been hamstringing wooden construction in the center of the city, and later in the whole city.

This has been the usual result. Enterprising citizens have made speeches among the flames and put up shacks and "to let" signs while water was still gushing from the hydrants. The business district, which heretofore most rigidly has strangled the city, is rebuilt before any new plan can be made or considered. Can burnèd Phoenix idly stand while neighbor Zenith waxes fat? Generally, mild improvements have been made in the legal construction requirements; occasionally some streets have been widened. When the East Side of New York burned in 1835, the chief boon was the establishment of the Croton River Water Works; the principal business quarter of Baltimore, destroyed in 1904, arose again but at a uniform height; the $75,000,000 fire in the business district of Boston, 1872, led to solid rebuilding with "widened and straightened streets"! Finally weep for San Francisco. Daniel Burnham had been commissioned to do a new plan for the city and had submitted it before the earthquake. It was well received. But the 1906 disaster, instead of accelerating achievement, actually resulted in complete dropping of the plan! Slight wonder, then, that planners are not entirely convinced that in the present catastrophe lies an unparalleled opportunity for our cities.

It is certainly true that for every St. Michael's smashed in Coventry were hundreds of ramshackle dwellings unfit for human habitation; that from the ashes of that flattened town can rise a city which would do more than gladden the heart of the archaeologist or the dilettante cutting blooms from the bush of the picturesque. To raise money to rebuild a bombed cathedral or a *monument historique* is unfortunately a lot easier than to finance the new housing which might rise from the shambles of the erstwhile picturesque slum. On Sunday, December 29, the Nazis caused the great 1940 London fire. By January 4, a wealthy young man had come forward offering to duplicate the Guildhall as soon as the war should be over. A brisk discussion now is being waged between those who would meticulously rebuild all the Wren churches and those who wish to strike out along new lines, (*Continued on page 220*)

Coal and the West

Is the Decline in Production of the World's Chief Source of Energy a Gloomy Portent or a Natural Occurrence in a Developing Culture?

By Paul Cohen

OSWALD SPENGLER said that civilizations exist in cycles; like a living thing, a civilization reaches a peak of vitality and effectiveness, then declines into extinction or oblivion. Spengler commanded attention chiefly, however, in his insistence that a like fate — perhaps in three centuries — awaits our own period. Earlier cultures can be shown to have followed the pattern he described, and certainly the present culture, struggling against wars and a rising tide of the Caesar spirit, is exhibiting symptoms which he declared characteristic of the final phase. Regardless of whether Spengler need be taken seriously — and this is certainly a matter of choice, in view of the failure of everyone else to show a mastery of the historical principles Spengler claims to exist — it is apparent that our period is not quite following the formula. In its widespread educational practices and in its methods of organized research, for example, the present era is showing unique traits that might easily upset Spengler's melancholy meditations, the potentialities of cyclotrons and institutions for the study of sociology being what they are.

Howbeit, several conditions in this civilization have for a considerable number of years been devoid of any rosy glow. Prominent among them is the course of coal production. Strictly speaking, it is not the coal which is important, for by itself coal is merely the basis of one among many large industries. Coal output, however, is still the best single indication of energy consumption, and energy consumption is as nearly fundamental an index of the Western world's material health as can be found. Of the substances which we exalted beings, the inheritors of the industrial revolution, require to maintain ourselves in our present unique manner, only water and air are used in greater quantities than is coal. During a normal year, for example, that statistical abstraction called the average American consumes or causes to be consumed some 30 pounds of textiles, 250 pounds of paper, 600 pounds of steel, 2,000 pounds of food, 2,500 pounds of oil products, and about 7,500 pounds of coal.

Statistics show, or did until the second world war blacked them out, that the Englishman uses even more coal than does the American (although far less oil) and that Germans, Belgians, and Dutchmen are not far behind in their need for the mineral. Previous to the cataclysm, the United States, Germany, Great Britain, France, and Russia mined 80 per cent of the world's coal. As a rough guess, that percentage was not far from the share they held in the world's wealth and influence. Because the world obtains three-quarters of its energy needs from coal and in the past has produced an even larger share of energy from this source, it mined 18 times as much coal as iron and 1,300 times as much coal as copper between the years 1800 and 1931. The point which these figures illustrate is that, among the many unique characteristics possessed by this mechanical age, none is more remarkable than its colossal appetite for power. Amply supported by history and the course of the present war is the view that coal is as important as all other minerals combined; that regardless of what other raw materials may be lacking, a country with ample coal reserves is halfway to being self-sufficient.

Certainly no drastically different presumption can explain the rise of England to a supreme position in the economic world. Except for the spirit and ability of her people and her rich iron ores (now badly depleted), Great Britain had few stronger aids in her climb than the quality and accessibility of her coal mines. Even their location close to tidewater had great significance by allowing their output to be moved at low cost, thus giving the United Kingdom an unchallenged first place as an exporter of coal.

At the other extreme is Canada, which, with considerably greater reserves than has Great Britain, must import 10,000,000 tons of the fuel annually, for Canada's mines are mostly in the far west or in the Maritime

Coal barges on the Monongahela

F. G. Skeyhan, '34

Provinces, thousands of miles from the centers of population in Ontario and Quebec. Fortunately for Canada, the latter provinces are richly provided with water power and are also only 500 miles from great coal fields belonging to her friendly neighbor to the south.

In a more precarious position is Italy, which at the moment must obtain practically all her coal over the four railroads crossing the Alps into her territory. Even the Italians do not believe that she can thus make up for the 10,000,000 tons of coal she formerly obtained by sea. As the American railroad situation shows, neither German nor Italian efficiency is impugned by this failure. A third of the tonnage, from apples to zinc, that moves over American rails is coal.

If one crowning example of coal's dominant role in an industrialized civilization were to be chosen, however, it would be the importance of coal's impurities. Like a hair from the head of Buddha, even 1 per cent or less of a chemical found in coal can assume significance. The amount of sulphur in coal ordinarily runs to 1 or 2 per cent, but Germany in 1939 was able to recover from the chimney gases of her power and coking plants a total of 80,000 tons of sulphur, a large part of her needs of that element. The figure is not particularly surprising when it is considered that some power plants burn as much as 1,000 tons of coal a day and that the chimneys of New York vent some 2,000 tons of sulphur dioxide into the city's atmosphere on a cold winter day. Were it not for this country's unsurpassed deposits of almost pure sulphur on the Gulf Coast, the United States, like many a European nation, might also find necessary and quite practical the exploitation of this mine in the sky.

Actually, sulphur is a minor by-product of coal. Far more important are the tremendous quantities of coal gas, liquid fuels, solvents, and, with further processing, explosives, dyes, perfumes, plastics, medicines, and so on indefinitely, which are recovered from coal. The only reason that the synthetic chemical industries of the United States are not so completely dependent on coal as are those of Germany and England is, again, the natural wealth of the North American continent, which lavished raw chemicals on oil fields and refineries.

Because some varieties of coal yield three pounds of tars, liquids, and gases for every ten pounds of raw coal fed into the coking ovens, the United States in 1936 obtained from coking plants more than 100,000,000 gallons of benzol, a fuel suitable for aviation and motor use; 20,000,000 gallons of toluol, vital for the explosives industry; 1,000,000,000 pounds of ammonium sulphate for fertilizers; 50,000,000 pounds of ammonia; and 560,000,000 gallons of tar. Only Americans can yawn at such figures, and then not too widely, for to countries like England and Germany, whose need for fertilizers is sharper than ours, whose oil wells do not drown their markets with an overabundance of liquid fuels and solvents, and whose inhabitants are barred from natural fats and rubber by the exigencies of war or trade, the chemical possibilities of coal are large factors in the ability to survive. Yet the by-products of coal are minor by comparison with its main product — power.

Freeman Hunt called steam the great civilizer. Living in a more cynical age, we may have our doubts, but certainly steam and other forms of power derived from mineral fuels are basic to our present form of culture. When energy was derived from human and animal sources, or from wind and water on the small scale possible in the pre-industrial era, two insurmountable obstacles faced all efforts to raise production materially. One obstacle was the inability to procure power that was cheap in terms of human effort; the other was the inability to concentrate great amounts of power into limited areas. Whether obtained from freemen, slaves, or animals, muscular energy is expensive. As the plantation owners of the South could have discovered had they been scientifically inclined, most of the food absorbed by animals, including Homo sapiens, is spent merely in keeping the organism alive. The gross profit associated with slave labor is invariably and sadly reduced by the costs of feeding, clothing, housing, nursing, and burying the creatures.

A mechanical horsepower costs from $20 to $50 a year and in many ways is more effective than the equivalent ten or fifteen slaves. Huge amounts of mechanical power can be concentrated into small areas and controlled with eye-widening precision — certainly no human muscles could actuate a modern continuous-strip mill. Mechanical power is also free of such human failings as boredom or carelessness, and can perform automatically, tirelessly, and uniformly for indefinite periods. Slavery, therefore, was the first victim of technological unemployment.

These are the reasons that have caused an expansion in the use of energy to accompany or, more accurately, to precede a rising standard of living. They explain why economists attempt to compute, with more enthusiasm than accuracy, the human equivalent of the per capita horsepower which various nations possess, the bolder spirits claiming that therein is a valuable clue to the cultural level of the nations. Incidentally, estimates of per capita power for this country range from the equivalent of 35 to 150 mechanical slaves, on which basis the United States is four times richer than peacetime Great Britain and six times better off than peacetime Germany. Such ratios are deceptive, however, because they are distorted by the enormous but little-used capacities of our automobile engines. It is more nearly accurate to compare energy consumptions, by which measure the United States is 50 per cent better off per capita than Great Britain and about 100 per cent ahead of Germany. Regardless of the precision of such figures, however, they serve well enough to indicate the advantage of a modern citizen over a citizen of Classic Greece, who had on the average no more than five Helots to insure him his leisure and luxuries.

Naturally, production is not merely a matter of power. Vacuum tubes, time studies, paper clips, alloy steels, adding machines, and the hundred thousand other products of technology also play their roles. Yet while it is impossible to evaluate precisely the part that energy plays in permitting a laborer at Boulder Dam to work thirty times as effectively as a slave on the Pyramid of Cheops, the use of power in large amounts is one of the fundamental differences between the two civilizations these structures symbolize. If the soul of technology feeds on research, its corporeal existence is maintained by energy consumption — or, largely, coal output — and

Martin Rosse, '40

the relation is evident throughout the last two hundred years of economic history, that is, throughout the life of this technological civilization. Great Britain, the prime example, first felt the industrial revolution around 1750 and maintained her economic supremacy certainly until about 1900, at which time the United States and Germany emerged as serious rivals. In the years that followed the World War, Great Britain did not regain her previous position nor did the world again enjoy the strong growth it had shown prior to 1913.

Those are the facts; here is how the coal statistics compare: In 1740, with coke already being used in blast furnaces, with Watt's steam engine still to be, Great Britain mined 5,000,000 tons of coal. By 1800 production was about 10,000,000 tons. Forty years later, she was mining about 35,000,000 tons annually, a sevenfold increase in a century. As the Nineteenth Century closed, Great Britain's production mounted to 220,000,000 tons and continued to rise to a peak not in 1937 or 1929 but in 1913. Today her peacetime production is back again at the levels of the early 1900's, a pattern that is characteristic of other countries. Although Germany tripled her consumption of coal between 1886 and 1913, she too has never exceeded the 1913 figure. In the United States, a very mild exception, production increased from 2,000,000 tons in 1840 to 445,800,000 in 1910 (she assumed world leadership in 1899–1900) and then continued to an all-time peak in 1918. Today, as in Great Britain, production is back at the levels of the early 1900's.

Thus, for the world as a whole, the Augustan era of coal production came to an end in 1913. The boom year of 1929 saw a higher output and so, probably, did 1937, but these are rather miserable achievements when compared with previous performances. Only as we note that coal output, for the fifty years preceding 1913, had been increasing steadily at the annual rate of 4.4 per cent (four times faster than the population and enough to double production every sixteen years) can the abruptness and magnitude of the break be appreciated. A few areas, either through the normal spread of industry over the world or the efforts of governments with ambitions of self-sufficiency, continued to increase output during the post-War period — Soviet Russia is an example — but for the entire world the trend of per capita coal output, until the temporary stimulus of armament production appeared, was definitely downward.

To those aware of the substantial progress which has occurred in the use of hydroelectric and oil power and mindful of the increasing efficiency which marks virtually every phase of present-day production, an obvious but fundamentally incorrect explanation may spring to mind: Coal's ills are purely its own; like those of the horse and buggy, they are the result of technical obsolescence. Quantitative comparison of the data, however, indicates that although water and petroleum power have been making their greatest gains during the period when coal output has been static or declining, and although industrial efficiency has been stimulated not only by normal advances in technology but also by many financial and labor conditions, neither individually nor collectively have these three factors made available the energy that would have been provided had coal production continued to grow at pre-World War rates.

Since about 1910, when the emergence of electricity as a major aid to industry enabled factories to utilize the power of distant waterfalls, the capacity of hydroelectric plants has been doubling every eleven or twelve years. Nevertheless, water power remains a severely restricted source of energy which, even if fully developed, would still not supply more than a fifth to a quarter of this nation's needs. Its share today is still under 10 per cent. Water power has taken over some of the market coal might have had, but only to a negligible extent has it interfered with the growth of coal production.

Petroleum and natural gas are not so easily dismissed, for in 1928 they accounted for 17 per cent of the world's energy and today produce a larger percentage. Yet while crude-oil production grew from 1,000,000 tons in 1871 to 211,000,000 tons in 1929, then, more slowly, to 295,000,000 tons in 1939 (world coal output in 1937 was over thirteen hundred million tons),* (*Continued on page 225*)

* Crude oils have higher heats of combustion (about 19,000 British thermal units a pound) than do coals (in general about 10,000 to 14,000 British thermal units a pound).

Housewife and Art

Excellence in Each Depends on the Same Group of Qualities— By These Standards Much in Modern Design Is Found to Be False in Idea

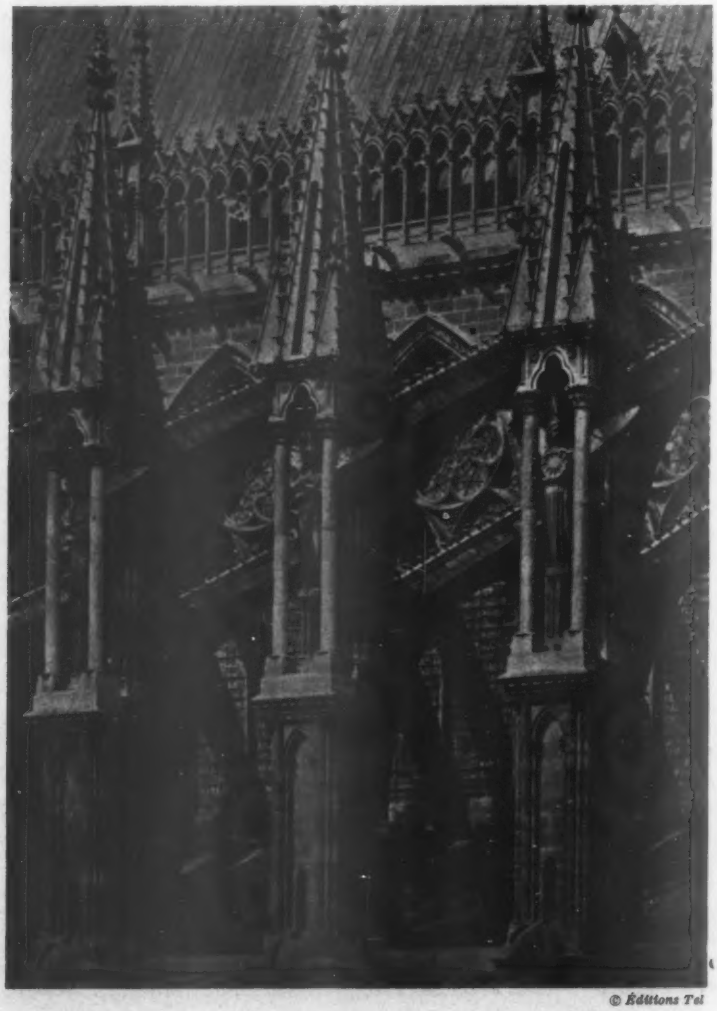
By Robert C. Dean

CAN it be that, while vast controversies on basic aesthetic principles rage among the devotees and practitioners of art, one vital precept has so far remained unnoticed? Can it be that this principle is the one most sought by the public? Several aesthetic maxims are generally accepted as valid by the majority of practitioners and critics alike: pleasing proportion, unity of scale, interest in texture, and interest in color. All the objects which have been almost universally accepted as beautiful have had these qualities, but there is another attribute which must be found in any object for it to achieve wide popular acclaim. For want of a better name, this attribute may be called visual functioning. Man likes to see how things work, what makes them tick, what makes the wheels go round, or what makes the parts hold together.

When recognized by the artist, this interest in visual functioning can be exploited in the shaping of his art, so that popular esteem can be caught and held. This aim of course flies in the face of those who contend that art is not popular, that the people is a great beast with no appreciation of the finer things. To disprove such a theory we have only to remember the great popularity of the work of the Greek, Medieval, and Renaissance architects, sculptors, and painters, and of the German musicians.

Popular favor has always been enjoyed by the art of great periods despite the failure of some individual works to achieve it; its attainment should be the goal of all who practice any form of creation which can be seen or heard by man. Consider for a moment a few achievements of our own times and country. No one escaped that peculiar thrill which quivers the spine, that celestial happiness, that feeling of individual well-being and power which are symptomatic of aesthetic experience when he saw under full sail one of the great clippers of Donald McKay racing up from the Horn. A person would have to be dull indeed to remain unmoved by the sheer beauty of Brooklyn Bridge, of the George Washington Bridge, the Triborough, or the Golden Gate, newest and greatest suspension bridge of them all. Who has escaped the sharp surge of emotion when a great transport roars overhead and disappears in the mists of the horizon?

Many will claim that these emotions are not caused by works of art. But what, pray, is a work of art? Is it not anything which will create in the beholder emotions here described? Anything which can evoke them is beautiful; art's main purpose is to create beauty. Why, then, are these three objects — the clipper, the bridge, and



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". . . No mere ornament . . ." — buttresses of Rheims Cathedral

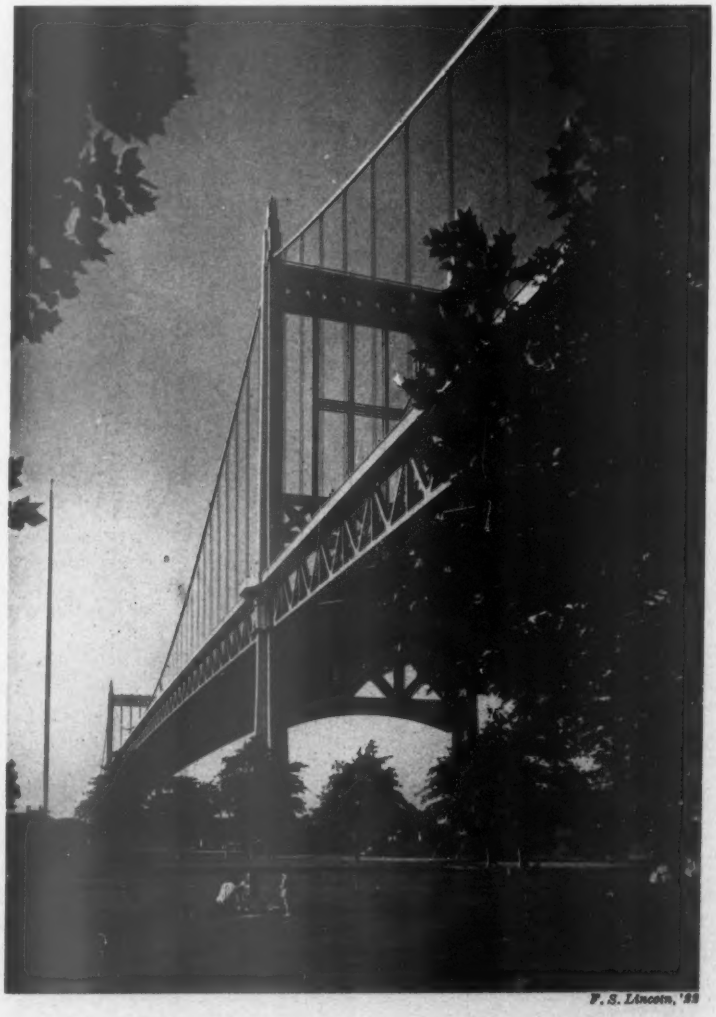
the airplane — so much acclaimed for their beauty? Firstly, they represent the works of some of our finest brains, just as Greek sculpture, Gothic architecture, Renaissance painting, and German music represented the best brains of their times. Secondly, the beholder can see and feel how the objects function. The designer of any of these objects has to deal with forces which permit no overloading, no useless parts, no pants or skirts put on for supposedly aesthetic effect to disguise supports. He has of necessity to work with useful parts and with none other. He strives for grace, neatness, proportion; in fact, the very qualities which constitute a good housewife are those which he uses to make the work of art. Compelled by this instinct to achieve beauty, he must make working parts graceful. Wishing to suggest power or speed, he must shape his whole object so that the impression of speed is there. As he needs to suggest strength, his parts — though fragile — must be arranged to inspire confidence. That he succeeds is too well attested to need exposition, for here is the beauty of working parts combined into a functioning whole, each part having its own beauty, and the whole having unity, scale, proportion, and grace.

The greatest periods in architecture — at least by the criteria set up here — have been the Greek and the Gothic. They were and are popular not only with the masses but with scholars, artists, and the gods. In both these architectures the functioning of the structure is visible; the working parts show. The Greek column is nothing but an ordinary post, well understood by the layman. It has been refined to the utmost by great architects, but never have they disguised the fact that it is a post, nor have they ever, with the exception of the rare caryatid, attempted to use for this purpose any unpostlike form. The entablature is merely the commonly understood beam, refined and proportioned. The cornice is simply a watershed; the triglyphs, beam-ends. Thus the Athenian citizen walking on the Acropolis could see and understand how the stresses caused by weight and wind were carried to the rock on which he stood. Being conscious of the stress and weight of his own body, he felt a spirit of kinship with the building before him and, feeling thus, was made more receptive to the beauty of its form.

Finest example of visual functioning as a means to popular beauty is Gothic architecture. Any observer of this great art in its original form can feel the sheer joy of its creators. Gothic architects were men who were using to the fullest the skill of their hands, the cunning of their brains, the expression of their emotion, and the accumulated knowledge of their time. Their happiness in their work, their sense of its fitness, of its use to humanity, and of its acceptability to God are powerfully transmitted to us by their creations, be they great cathedrals or humble dwellings. In Gothic architecture we have a great structural invention, consisting of the arch, vault, and buttress, carried to a logical conclusion. Here we see the possessor of the inventive mind throwing his vaults ever higher and wider until the ultimate strength of his material is reached. Fortunately for his spiritual happiness, this obvious end was reached almost at the same time that the public need for his services collapsed.

The most characteristic exterior form of a stone Gothic building — the shape which dominates and, even more than the tower, means Gothic — is the great buttress. This is no mere ornament. It is an essential of the skeleton of the whole building. The artist has embellished, he has proportioned, he has modified, but he has never disguised it. Its enormous variety demonstrates his love for it, his imagination in its use, and his masterly knowledge of its powers and limitations.

Internally, also, the building is alive. The great arches, forming ribs, support the vaults and are in turn supported by the piers. Through properly placed clear



F. S. Lincoln, '42

". . . Useful parts and . . . none others . . ." — the Triborough Bridge

glass windows the great external buttresses can be seen butting, the arches pushing, and the piers supporting. This spectacle is what is so fascinating to the public: beautiful forms working, arch thrusting against pier and buttress, pier and buttress resisting arch — all in a harmonious whole. Window glass, a necessity in this northern church, has been carried to its ultimate beauty. Nothing created in glass before or since is so fine as the beauty of the blue windows at Chartres; yet they are and always were just fillers for openings intended to let in light and to keep out weather. Their beauty in no way interferes with their function, nor does their function interfere with their beauty.

Such unity of purpose is understandable; it gives a feeling of spiritual satisfaction and is, therefore, popular. Page after page could be written on this marvelous Gothic art. In the exposition of every part, from the topmost pinnacle of the spire to the great platform on which the building is built, will be found this same remarkable unity of function and beauty. The whole period is one of visual functioning triumphant.

Just as these products of man's art are universally accepted as beautiful, so there are forms in nature which he popularly acclaims. Man himself is regarded as most beautiful when his functioning is visible and the working forms beautifully proportioned, colored, and textured. No man — or woman — is considered beautiful when layers of fat obscure the line of the jawbone, the set of the hips, the functioning of the muscles. Not only must he be well proportioned, pleasing in color, and fine in texture, but the functioning of his body must be seen or suggested in order for his beauty to receive popular acceptance. This combination is one reason for the popularity of female beauty. The unity of function and its expression is so apparent in her face and form that it strikes the beholder full force, immediately capturing his imagination and enslaving his emotion.

Among the animals, beauty is popularly attributed to dogs, cats, antelope, and birds; ugliness to pigs, hippopotamuses, whales, Gila monsters, and many fish. The ugly ones are those whose forms are not well proportioned or whose function is concealed by their forms. There is no reason why the pig should not be held in as great affection as the cat. Surely the pig is more useful, but we cannot watch the ripple of his muscles as he leaps over his trough, or see his claws go in and out, or revel in the grace of his movements as he roots up the peanut patch. Ugly plants are rare. Nature here combines all her efforts to produce visual functioning. All the beauty in the plant world was not created for the enjoyment of man. Man has found it beautiful according to his own standards, one of which is his ability to see it function.

In this attribute of beauty the strongest case can be made against Modern design. On the desk is a stapling machine — a simple enough tool. Its purpose is well known. Some industrial designer has played with it until now it looks like a streamline tricycle. It has no wheels, but it gives the same impression of streaking along at 240 miles an hour that the small child's tricycle gives. Here is not a beautification of essential form. Here is the grafting on of a stylistic trend that is rotten to the very core. Here is no understanding of the very essence of beauty or of creative control of aesthetic pleasure. Here is the product of a man, himself the product of a school of abstract design which is doing violence to the unity between form and function. Furthermore, the public does not want Johnnie streaking around the living room at 240 miles an hour, nor does it want Johnnie's tricycle to look capable of making that speed. Neither does the public want its stapling machines, its bicycles, or its houses to look capable of that speed. Man wants these objects to be beautiful. He may be momentarily deceived by some aesthetic fad, but not for long. Soon this streamline fashion will pass, and its appearance will be confined to torpedoes, aircraft, porpoises, birds, and greyhounds.

Even the streamline locomotive is not so dear to the heart as is the old puffer. This is no mere nostalgia: We could see the old-timers work. We could see the pistons push, the drivers drive, the safety valve blow, the smokestack smoke, and the brakes brake. These essential parts can be and often are beautiful. They were combined into a beautiful whole and (*Continued on page 229*)

". . . Dear to the heart . . . the old puffer. . . ."

The Worth of the Initiative

The Doctrine of Limited Liability One of Many Shortcomings in the Affairs of Nations; the Moral Initiative Vital to Maintenance of Democracy

By Henry M. Wriston

A POSITIVE idea can never be beaten by a negative one, even if the positive idea is weak and the negative one is potentially stronger, but the upholders of the positive idea must seize the initiative in order to be the masters of their fate. The world is now suffering because the democracies yielded the initiative to the dictatorships. The democracies took defensive positions and, operating under a philosophy symbolized in the military sphere by Liddell Hart, applied the doctrine of limited liability not only to military operations but also to political strategy.

The false sense of security which persisted while the military initiative was abandoned and the Allies rested behind the Maginot line has now been shown to have been folly. The military mistake, however, was preceded by an identical, but even more serious, error in moral and political strategy. This consisted in a like abandonment of initiative to the totalitarians. It is now being followed in Europe and in America by an error of similar character and dimensions in still another field — the abandonment of the peace strategy to the totalitarians.

The Versailles Treaty was not a good treaty, but it was probably as good a one as is likely to be made at the close of a long, bitter, and exhausting war, by statesmen whose first preoccupation is certain to be continuance in office. Though it was not a good treaty, it was, nonetheless, a better treaty than it is now given credit for having been.

Through the years the treaty became progressively less viable. Its evolution in action was degenerative, partly because of the negative philosophy and action of the United States. The failure of the United States to participate in the tripartite treaty of guarantee destroyed one of the presuppositions of the Versailles Treaty. The failure of the United States to participate in the Reparations Commission (though twice later we had to intervene "unofficially," with the Dawes Commission and the Young Commission) impaired its value as an instrument of flexible peace. The failure of the United States to participate in the World Court deprived the treaty of a third of its potentialities for peaceful change. The failure of the United States, which had launched the League of Nations, to take a positive attitude toward it contributed to its ineffectiveness as an agency for peaceful political reorientation.

Instead of developing into an instrument of positive action, which it might have done, the treaty by this negative policy became a kind of Maginot line, strongly defended toward the front but open to a flanking movement which made its defenses useless. The way for a German flanking movement was prepared by many in Britain and many more in America whose destructive criticisms of the treaty were not balanced by positive alternative proposals. The criticisms by which the moral position of the treaty was destroyed were the same in the three countries — but with this difference: The Germans had a positive substitute for the treaty, whereas the United States and Britain paved the way for that substitute by participating in the moral abandonment of what already existed without offering any substitute of their own. We participated, that is to say, only in the work of destruction. The unworthy positive idea of the totalitarians — reform of the treaty by force — prevailed over a negative attitude. The available positive ideal of a flexible peace, inherent in the treaty as drafted, was lost because of failure to retain the political and moral initiative.

When the moral position of the treaty had been destroyed, the Maginot line of peace was turned, and mobile forces of political intelligence were not available for effective resistance to the German program. Once the moral initiative with regard to the structure of peace was conceded, the overthrow of peace was only a matter of time.

In the same way the moral initiative has been abandoned to the totalitarians in discussions of democracy. The "failure" of democracy, at least its failures, have been scarcely less the theme of public figures in France, Britain, and America than in the totalitarian countries. We have had over ten years of emphasis upon the pathology of democracy, with some evidence of consequent hypochondria. The "failure" of democracy to provide security, the "failure" of democracy to solve the unemployment problem, the "failure" of democracy to redistribute wealth, "failure" in a hundred other ways have been exploited by Americans and British as much as by Germans.

One recent British author, who is much and widely admired in America, in writing on the strategy of peace makes the flat statement that "the character of our political institutions contradicts the possibilities of our economic achievement." That statement is characteristic of the defeatist point of view, which goes a long way toward admitting the strictures of the totalitarians. The criticisms of the last decade have been so completely negative that when the physical assault upon democracy was made, whole areas of the ideal were already in process of being abandoned; they had already been conceded to the aggressors, and needlessly conceded.

The critics of democracy have proceeded on the fallacious assumption that specific failures were due to inherent weaknesses of the democratic process rather than to ineffective instrumentalities and leadership. They have measured the achievements of democracy against Utopian perfection, not against standards applicable to a real world. Instead of taking the initiative and driving home the weaknesses of totalitarianism and exploiting the positive aspects of democracy, the "defenders" of democracy have admitted its weaknesses and confined themselves to defensive gestures against the totalitarians. Statesmanship, which had become defensive about democracy, attempted to intrench it behind the moral equivalent of the Maginot line, then watched helplessly while that line was outflanked and overwhelmed.

In the same manner the initiative has been conceded to the totalitarians in discussions about capitalism. Capitalism has not been discussed from a positive point of view during the last decade by statesmen anywhere in the world. It has not been aggressive in its assaults upon the theory of exchange control, upon the theory of barter, upon the theory of state socialism. The initiative has been left to Russia, to Italy, and to Germany, and their assaults upon the plutodemocracies, their sneers at alleged outworn aspects of capitalism, have been merely the echoes of negative domestic criticisms in the nations where capitalism has thus far survived. Even there its ultimate modification out of all recognition is conceded not only without a struggle but virtually without effective argument.

Characteristic of this defeatist point of view is the British writer previously quoted, who speaks of "the central contradiction within itself between capitalism and democracy. . . . Their relationship is satisfactory in periods of economic expansion; it becomes difficult in periods of economic contraction." That statement, typical of the luminous and arrogant simplicity with which the alleged breakdown of democracy and capitalism is described, says in elaborate words that trouble is trouble — and unpleasant. One can read his whole argument through, however, without encountering any hint that Russian communism has been anything other than a glad, sweet economic song — except as its capitalist neighbors have abused it! His is the kind of mind which shuts itself resolutely to any manifestation of privilege except that of wealth. The whole Hitlerian arraignment of plutodemocracy is tacitly accepted. Denouncing, as do most of us, the special privileges that often come with money, he closes his eyes to the special privileges that come with political power in a communist bureaucracy. Denouncing, as all of us would, the economic authority of any little group of capitalists over the welfare of masses of men, he resolutely closes his eyes to the power of life and death exercised over the masses by the dictator head of the totalitarian communist state. He blandly insists that democracy, to be effective in the current crisis, must "take large steps toward the transformation of the capitalist basis of its economic foundations to a Socialist basis." This widely acclaimed book, describing where we are to go from here toward peace, surrenders one whole area to the totalitarians without firing an intellectual shot.

The same author, who is characteristic of many more, closes his eyes resolutely to the development of dictatorship in Russia and has relatively mild words of condemnation for the manner in which Stalin has played the game of power politics. He assumes a fundamental difference in orientation between dictatorship in Moscow and dictatorship in Berlin and Rome. He assigns to the dictatorships of Hitler and Mussolini the characteristics of an outlaw but attributes to the dictatorship of Stalin the implementation of the dynamic of the masses. As he describes, step by step, the terror and tyranny by which the Nazi and Fascist masters made their wills dominant over their states, he is blind to the precise parallelism of means and method that marked the rise of tyranny in Russia.

Despite the suave phrases of such apologists, socialist or communist totalitarianism makes democracy impossible. Bureaucracy never submits even to phantom elections; bureaucracy never takes on the mortal release of death, which even the dictator can never escape. Bureaucracy, which is the essential instrument of totalitarianism in its socialist, communist, or any other form, is of all forces the least responsive to the popular will.

Let us repudiate the defeatists. Compared with totalitarianism, democracy has no need to be defensive. The inherent weaknesses of the totalitarian state are decisive. I shall mention only four and shall offer but a word on each.

(1) Totalitarianism means physical impoverishment. There are no vitamins in guns, and when guns are put before butter long enough, such a policy must exact its inevitable physical toll. But propaganda screams the word "equality," and the pretense is made that if the sacrifice be common, then there is no sacrifice at all.

(2) Totalitarianism means economic impoverishment. A nation's main productive forces cannot be turned into destructive channels over a long period of years, energies cannot be put into fashioning things which produce no dividends in goods, money cannot be spent upon a scale which taxation can never meet, without resultant economic impoverishment. But again the emphasis in propaganda is upon "equality," and by a strong assault upon alleged plutocracy, it again makes the false pretense that common sacrifice means no sacrifice at all.

(3) Totalitarianism means intellectual impoverishment. Bureaucratic control is necessarily hostile to intellectual freedom. There is no mind that betrays less evidence of imagination, there is no mind less inventive and in the long run less sympathetic, than the official mind. When the mind of science and the mind of literature and the mind of art are harnessed in team with the official mind, they inevitably lose that freedom, that sweep, that reach which have brought science its untold number of triumphs, which have brought richness and beauty and meaning and power to letters and the arts.

(4) Totalitarianism means spiritual impoverishment. For if the state is made one's god, the result is no better than if an idol were fashioned of gold or of clay. Even if power were not the inevitable objective, the baser life would be substituted for the fuller and richer life.

If control over others is substituted for mastery of oneself, the result is a loss for which nothing can compensate.

But, having crushed minorities, having purged dissidents, the totalitarian state insists it has achieved "unity." By inhibiting creative power outside official channels, by controlling every aspect of life, and by substituting a false enthusiasm for the state in place of reverence for God, the totalitarian state tries to make the world believe that the minds and hearts of men are one. If we are so inert in our defensive position that we do not seize the initiative, tear those pretenses away, and show all the forms of physical, economic, political, intellectual, and spiritual poverty which lie behind them, then our superior democratic ideal will never conquer the inferior totalitarian ideal which flaunts its bold claims.

The soundness of the military aphorism that the best defense is a strong offense is now obvious. It should have been clear from the beginning — at least after the German annexation of Austria had turned the Czech fortress line — that a defensive military position is untenable. If the immovable body does not crumble before the irresistible force, the force flows around it and achieves the same result.

It should be equally clear by now that a negative attitude cannot resist a positive idea, and that when the moral initiative, the intellectual initiative, and the physical initiative are surrendered, and trust is reposed in defensive positions, those positions will be lost, one after another, either from the front or, more likely, from the flank and the rear.

That is why it is so serious a matter to have abandoned thus far the initiative regarding the shape of the coming peace. There are current in the democratic world no theory of the peace, no aggressive principles which the peace is designed to implement, no clear picture of the kind of world in which we are ready to participate, no definition of the responsibilities we are ready to assume, no intimation of the structure of our own hopes. American pessimists have been as quick as the Germans to open the pathway through the flanking forest of the Ardennes by saying that free exchange is a thing of the past; by asserting that the gold standard, or anything like it, is a thing of the past; by declaring that free enterprise in the international sphere is a thing of the past; by admitting that small nations probably cannot maintain themselves; by anticipating in the future some hegemony within spheres of influence, such as is involved in the conception of hemispheric defense and hemispheric economy, or a partition of the world between the democracies and the totalitarians. All these concessions mean that even if the totalitarians lose the war, they are likely to win the peace. Aid to Britain is no substitute for clear thinking.

The hope of peace is an old hope. In our greatest work of literature, the Bible, peace as an ideal appears again and again, always with yearning and sometimes with magnificent faith. The periods when the world has moved toward peace have been those when hope was reinforced by faith. Today, when even hope is dimmed and faith is all but absent, the totalitarian faith in conquest is for the moment triumphant and the totalitarians can define their "new order" while we flounder without a program. Our absence of faith in any contrary process gives them the victory. If we are ever to have peace, then more vital than guns, more vital than butter, is a reawakening of faith in the validity of our ideals — a resurgence of faith in the democratic process, a readiness to see those ideals and that process operate upon an international scale.

One of the ironies of life is the inability to have peace without being ready to run the risk of war. For peace is not an end in itself; it is a means to an end. It is the opportunity to fulfill some (*Concluded on page 229*)

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The Great Hall of the University, Bristol, England, after an air raid

The Humanities at Technology

A Wider Definition for Such Studies a Basic Element in the New Education Begun at the Institute in 1865; the Varied Course of Their Development

By Robert G. Caldwell

WHEN the Massachusetts Institute of Technology opened its doors in 1865, its new educational experiment was frankly revolutionary. The program of the American college at that time still centered on required courses in the classics. President Rogers had become convinced that with the rise of science and technology, a new type of education was definitely required. He had thought about his plan for many years and had published his first outline as early as 1846. For more than twenty years he had been dreaming and planning, and now his great dream had come true.

The new education was to be genuinely democratic: It would start with the practical needs of industry and life and not hesitate in its effort to meet those changing needs; it would emphasize learning by doing and would accordingly be based on actual laboratory manipulation by the students themselves; and it would give a new definition to the old and respected name "humanities" by including subjects like modern languages and literature, history, philosophy, and the social sciences — subjects which in his judgment might well be combined with professional subjects in a broad and generous effort to provide, as he said, "an education which might be not merely useful to the individual, but which in the course of time would furnish well-trained leaders for any branch of activity within the state."

His was an ambitious program and, as the years were to show, not without inherent difficulties. Nothing, however, had been left to chance: Every detail of the new program had been thought through, and difficulties had been foreseen not only with prophetic insight but with constant and meticulous care.

The first Faculty of only ten members included a full professor of modern languages and a professor of the English language and literature. In 1871, these two professorships in the humanities were increased to three by the appointment of George H. Howison as professor of logic and the philosophy of science. The first professor of English was William P. Atkinson, brilliant, witty, and effective, who continued to serve the Institute until his retirement in 1889, almost a quarter of a century after its foundation. Indeed, the continuity of the humanistic tradition has largely been guaranteed by the fact that three successive Heads of the Department of English altogether have had virtually an unbroken period of service lasting from the very beginning almost to our own day, and have therefore been in a position to maintain an ideal which might otherwise have been lost in the inevitable competition with professional demands.

The first President announced that the Course in English had "mainly in view the acquirement on the part of the students of a habit of clear, precise, and accurate statement of their thoughts upon paper." Similarly, "in the study of the Modern Languages, the practical purposes of men engaged in scientific pursuits will be kept in view." Hence these languages were not to "be cultivated as *accomplishments*." The aim was "to enable the student to read such works as may have a bearing upon the studies pursued in the School, — so that, in the latter years of the course, French and German textbooks may be used in any department, as well as English ones."

The Departments of English, History, and Economics have included distinguished names. After Professor Atkinson, already mentioned, the Head of the English Department from 1893 to 1915 was Arlo Bates, a well-known novelist and poet of his day. Professor George R. Carpenter, who later won a distinguished position as a philologist, was a member of the Department for some years, as was Professor Frank Aydelotte, now director of the Institute for Advanced Study. At various times special lecturers have been employed. The names listed in the catalogues include John Fiske; J. Franklin Jameson, for many years head of the manuscript division of the United States Library of Congress; A. Lawrence Lowell, later President of Harvard University; and Louis D. Brandeis, the distinguished jurist.

All these gentlemen found the task of teaching English to engineering students engrossing but obviously not without difficulties. In an early report Professor Atkinson outlined his policy in this respect: "I have taken the ground that while the Institute of Technology does not offer itself as a teacher of writing, spelling, punctuation and the rudiments of the art of composition, it will give all the incidental help it can to its students for the making up of such deficiencies in their school education, but should refuse to give a degree or diploma to anyone who, by the end of four years, has not acquired . . . a satisfactory proficiency in them."

Apparently, however, the difficulties of many students continued; for in 1890 and for many years thereafter when Arlo Bates was head of the Department, students in the required course in first-year English had to be divided into two groups. The first list included those who displayed "unusual aptitude and pleasure in composition." They were offered opportunities for advanced study.

As to the others, the report of 1890 continues: "More important still, lists will be made of those students, beginning with the very first year, who, from lack of

natural aptitude for such studies, or from defects of training, are found to be at a special disadvantage in English composition." These students were to be followed up with "an unremitting but friendly importunity, to induce and enable them to correct their faults and supply their deficiencies on this side."

From the outset, all regular students in the six professional Departments were required to take certain so-called general studies in addition to the elementary courses in English, history, and modern languages. For third- and fourth-year students the program of studies set in 1865 was clearly ambitious and, in contrast with the one which is in effect today, was rigidly prescribed without options. It included German and French; lectures on history, political economy, and the science of government; lectures on mental and moral philosophy; instruction in logic, rhetoric, and history of English literature; and instruction in zoology, physiology, and botany.

Early students must have been serious and hardy. At any rate, in 1875 the Professor of Philosophy was able to report that his third-year students had "thoroughly read the following matter: — Descartes' *Method*, and his six *Meditations*, entire; Spinoza's *Ethics*, in outline; Leibnitz's *Monadology*, *New System of Nature*, *Nature of the Soul*, and *Doctrine of a Universal Spirit*, entire; Locke's *Essay*, in its most important parts, with Cousin's Critique of the same; Berkeley's *Principles of Human Knowledge*, entire; Hume's *Inquiry Concerning Human Understanding*, — the first eight sections."

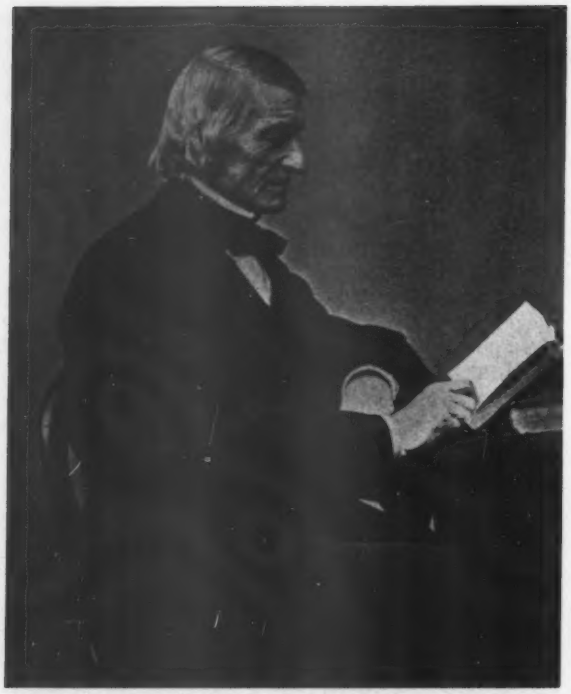
After the first two years, however, the early emphasis on philosophy proved no longer feasible, and we find that courses in philosophy were replaced to an increased degree by the social sciences, economics, comparative government, sociology, and international law. Some of these subjects were taught with brilliant success by President Walker during his long incumbency.

As time went on, a wide variety of choices was provided which led gradually to the list of General Studies as it stands today, including subjects as different as the history of science, psychology, and the appreciation of music.

From the very beginning, accordingly, all students being graduated from the Institute have had generous opportunities to become acquainted with methods of historical investigation and with masterpieces of literature in various languages. It is worth noting that the interest in philosophy, which decayed so rapidly in the Eighties and Nineties of the last century, has been renewed in our own time and that many students select such courses as Problems of Modern Philosophy and subjects in pure and applied psychology, which seek to explain the relations of science and human life.

For students who are busy with scientific and technical pursuits, one of the chief difficulties connected with any humanistic program has always been to find sufficient time for the generous amount of reading which is required. In the constant effort of the Faculty of the Institute to meet this need, a very interesting experiment was worked out in 1897 and continued with some interruptions until 1923, a full quarter of a century later. Under this plan all students except college graduates who were working for advanced degrees were required to complete courses of reading of a nonprofessional character during the summers following the first and second school years. The books to be read were to be chosen by the student himself from yearly lists, to the selection of which, it is quite apparent, much careful thinking was devoted. In the early years the books for summer reading were chosen by Professor Arlo Bates. Of various Presidents during this period, Richard Maclaurin was especially interested in a plan which was obviously similar to practices to which he had become accustomed in his Cambridge days and from which beneficial results have been obtained by many generations of English students. Professor Archer T. Robinson and Professor Robert E. Rogers, still members of the Faculty, later took a leading part in the selection of books and in conferences on reading done during the summers.

J. E. Tyler, '40



WILLIAM BARTON ROGERS

. . . founder of M.I.T., whose claim to prophetic insight appears established by his emphasis on cultural values of scientific study and the need for enrichment of natural sciences by humanities

The various lists, published at the time for the convenience of the students, still serve as an admirable illustration of types of books regarded highly by thoughtful men and also of the changing currents of intellectual life about the turn of the century. The tastes of the various compilers were evidently catholic and liberal in the widest sense. Thus in the very first list, that for 1897, we find excellent books carefully chosen and listed under history, poetry, essays, fiction, and science. In that earliest list the scientific books which were recommended included J. Tyndall's *On the Scientific Use of the Imagination*, E. B. Tylor's *Anthropology*, and T. H. Huxley's *The Advance of Science in the Last Half-Century*. For second-year students A. M. Marshall's *Lectures on the Darwinian Theory* were recommended. In later lists we find such books as Simon Newcomb's *Astronomy for Everybody*, in 1907; Vallery-Radot's *Life of Louis Pasteur*, in 1915; and many other similar works of special interest to young men who were commencing a scientific career. As time went on, in addition to carefully selected books in the fields of fiction, history, and philosophy, an increasing number were books of travel like E. A. Ross's *The Changing Chinese*, in 1921; or W. C. Cabot's *In Northern Labrador*, in 1922. In later years, particularly after the World War, many books dealt with insistent contemporary problems in politics, international relations, and economic life.

As a result of the broad humanistic and social interest of President Francis A. Walker, who was one of the most distinguished economists of his time, the Faculty set up in 1891 a special Course of a definitely liberal character which a student might pursue toward a degree throughout his four years and which ran parallel to the professional courses.

Course IX, as General Studies came to be known by three generations of students, was in its day an extremely interesting educational experiment; many colleges still centered their work around the classics, and there was accordingly room for something new and fresh. This Course, under the initial leadership of President Walker and later under Professor Davis R. Dewey, gave to a small but increasing number of students at M.I.T. a very real opportunity to commence with scientific training and from that starting point to pursue courses of study which, in the fields of modern languages, history, economics, and other social sciences, were for the time unusually well rounded and complete. From 1891 until final abandonment of the Course in 1904, numerous changes of detail occurred, but from the beginning to the end scientific, humanistic, and social methods and objectives were blended with remarkable care and skill.

The discontinuance of Course IX in 1904 seems to have been due to the fact that by that time similar courses had been widely introduced into ordinary universities. Such a program, given by a scientific institution of the type of Technology, seemed to duplicate to some extent opportunities which were available elsewhere. Further, in the Institute a Course of this kind reached only a comparatively small number of students, and there was a feeling on the part of the Faculty that if General Studies were useful for some students, opportunities of this kind should be made more widely available even in courses of a definitely professional character.

Whatever the reasons, the result was that in 1905, the year following the abandonment of the old Course IX, the name General Studies reappeared in the sense in which this term had been used originally by the founder of the Institute. These studies no longer referred to a single Course leading to a degree but to electives taken, for the most part, in the third and fourth years and open to students of all undergraduate Courses at the Institute. In this new form General Studies have been a regular part of the program for the last thirty-five years.

These studies have been defined by the Faculty in recent years as "subjects of a general and essentially non-vocational character which are offered for the purpose of giving the student an opportunity to broaden his education" by introducing "him to fields of thought and interests outside of his chosen professional work."

The importance of this part of our work is shown by the fact that, during the first term of last year, 617 students were enrolled in these courses, and during the second term, 787. The list from which the students made their selection varied widely in character and content, including fifty-seven separate subjects, or approximately thirty for each term. With one or two exceptions, the fairly large number of courses has made possible in recent years small sections and intimate contact with the instructor.

IT is quite clear that through many interesting experiments and in various ways the Institute has remained true to the ideal of its (*Continued on page 227*)

THE INSTITUTE GAZETTE

PREPARED IN COLLABORATION WITH THE TECHNOLOGY NEWS SERVICE

Davis R. Dewey Honored

His Contributions to American Economic Association Signalized as He Retires from Editorship

PRESENTING his successor with a blue pencil as insignia of the editorial office, Davis R. Dewey, Professor Emeritus of Political Economy at Technology, relinquished managing editorship of the *American Economic Review* at a gala banquet given in his honor by the American Economic Association in New Orleans late in December. Resolutions stressing Dr. Dewey's contributions to the welfare and growth of the society during his fifty-five years with it and signalizing his work through thirty years as managing editor of the *American Economic Review* were one expression of the association's esteem for him. Another was the presentation of a folio volume bound in green morocco, with illuminated title page and headings, containing the resolutions and hundreds of letters from leading economists attesting their appreciation of his work and their regard for him. Inserted in the front cover of the volume is a bronze medal especially cast in his honor.

Dr. Dewey's address at the dinner was regarded as the high point of the event. "My brief remarks," he said after being presented, "will be divided under five headings: (1) grace or thanksgiving; (2) confession or apologia; (3) sermon; (4) ordination of my successor; and (5) benediction. Five points may seem a formidable program, but let me assure you that long training has made me an expert in the art of condensation. I once successfully condensed a Federal public document to 1,228 pages."

Saying his thanks to the association not merely for the banquet but for an enjoyable task extending over many years, and reminiscing concerning the first days of the association, Dr. Dewey recounted his early experiences with the *American Economic Review*, explaining that he had demurred when asked to accept the editorship, partly because he did not easily read foreign languages, partly because his chief interest was in American economic problems rather than in the refinements of theory, and partly because "such economics as I had imbibed was imbedded in a thick layer of Vermont G.O.P." The questions of finance and policy which had busied him, Dr. Dewey sketched briefly, saying that with the aid of successive boards of editors effort was to maintain a high level of scholarship and at the same time to widen the field of contributions.

"Too much praise cannot be given to their patient and time-consuming appraisals," he said in referring to the boards of editors. "A large part of the tribute which you are paying me should be bestowed upon them. They have been my ghost writers, and due credit should be given to their gratuitous service. There is another ghost writer to whom credit should be given — namely, my office assistant for fifteen years, Miss Beatrice Rogers. She has saved many a contributor from mortifying grammatical mistakes, and she does not know what time means."

Dr. Dewey's address continued as follows:

I now come to the sermon, which I hope will not be out of place. For thirty years I have been occupied in reading manuscripts and giving hasty, and regrettably only superficial, consideration to the thousands of volumes published in our field of study. These volumes may be roughly divided into two classes: (1) factual studies or reports of investigations; (2) speculative and theoretical discussions of the working of economic principles or laws.

With the first class I have no concern. Factual studies are all welcome, for they furnish the data needed for the second class. It may be that some of the authors of this first class are not necessarily economists in the true sense of the term. They are machinists who do the mechanical work for the engineers.

My special interest is in the authors of the second class. What is the competency of writers on economic theory? What sort of training have they had to warrant their prescriptions for social welfare? Have they some sort of certificate which warrants the appellation "economist"?

Now it must be recognized that our universities have attempted to solve the question of certification by laying out courses leading to a doctorate, and there is a growing tendency for administrative officers to demand this certification as a price for appointments.

This recognition brings us face to face with the character and quality of the Ph.D. degree in the field of economics. Does the degree represent the accumulation of a certain number of credits in detached or scattered economic subjects, supplemented by a so-called research termed a thesis? Or does it mean a ripening of scholarship in the wide expanse of economic life?

M.I.T. Photo

Face** (upper) **and reverse of the medal honoring Davis R. Dewey's contributions to the American Economic Association

Is not the curriculum for the Ph.D. degree frequently too strictly confined to economic subjects, and should it not include a larger proportion of history, politics, psychology, philosophy, and jurisprudence? Is not a knowledge of American and foreign constitutional history an absolute requisite for understanding and interpreting the working of economic principles?

If there were this knowledge, it seems to me that some of our economic theorizing and writing would be more effective. I am not reflecting upon the scholarship of the present holders of the doctorate in economics, but I sometimes wonder whether there is not a tendency to narrow the preparation too strictly to the economic field.

May I now give a few words of advice to our new managing editor? (1) Be sure to have one article containing involved mathematical equations with unusual fonts of type. Inasmuch as the printer has to spend a good deal of time in ransacking the type foundries of the country, this affords you a good excuse for a delay in publication. (2) Be sure that a majority of the leading articles contain at least six references to John M. Keynes. Adam Smith, John Stuart Mill, Alfred Marshall, Francis A. Walker, and their contemporaries are now passé. And it is your duty to see that the articles you select do not burden the readers with reasoning which has been outmoded. (3) Publish at least one review in each issue which will arouse the animosity of the author. There is nothing more stimulating than controversy. Is not controversy the essence of that much-debated theme, democracy? In a recent address at Cornell University, Professor Carl L. Becker reminded his audience of a German saying that a professor is a man who thinks "otherwise." As I look back over the *American Economic Review*, I am inclined to think that this definition fits many of its contributing writers. There is a great deal of "otherwise" opinion. Some of the leading articles may be so characterized; and a reviewer appears to think that no matter how favorable his review is, he has not fulfilled his duty unless he injects an "otherwise" qualification. (4) Be sure to have occasionally an article containing fifty-cent and dollar words. Though difficult to understand, such an article commands respect; and economists in these days need respect. . . .

Age becomes casehardened and overconservative. I welcome the change to youth, and commend my successor to the same generous support which you have given me . . .

Finally, the benediction; fortunately a benediction is always short. May the blessings of wide scholarship and sound reasoning attend the remaining years of your lives.

Industry and the Emergency

DISCUSSING industry and the national emergency in an article in the current issue of the *Magazine of Cambridge*, President Compton expressed his confidence in the public spirit and capacity of industry to meet our national needs and to implement our national objective of serving as an arsenal of democracy.

"There has been," he said, "a certain amount of impatience over the rate at which the wheels of industry are turning in these grave days. Some of it, no doubt, has been justified, but more has been due to a lack of understanding of the factors involved in the enormous task of producing in quantities undreamed of a few months ago.

"In a few instances industry must learn to use unfamiliar tools in the manufacture of new products, but in general the problem is one of quickly increasing production. Here and there plant facilities must be expanded, but more often the problem is one of manpower and efficient utilization of existing equipment.

"There is a tendency in the excitement of the moment to lose sight of the fact that not all industries will be called upon to manufacture defense supplies. There is, perhaps, no more effective illustration of unpretentious patriotism than the manufacturer who calmly continues to produce with the utmost efficiency the necessities of daily life. In doing this he is contributing to the security of national morale just as effectively as his colleague who is engaged in the more spectacular task of manufacturing instruments of defense. . . .

"It was apparent early in this national emergency that there would be a shortage of technically trained men and skilled workers when defense production gained momentum. That need was anticipated by our schools and colleges in the far-reaching program of training now going on in our engineering schools, colleges, and thousands of high school manual arts departments and trade schools. This project has a significance far deeper than the immediate goal of training for defense work. It has opened to young men opportunities for technical training in the engineering professions and the highly skilled trades which otherwise might not have been so readily available. . . .

"It would be short-sighted, indeed, to think that industry had discharged its duty by supplying only the weapons and the supplies of defense. That is only part of the task of this national emergency. Beyond the horizon rides the sun that will mark the dawn of a day when we shall stack the instruments of war and pick up the tools of peace. What then? The answer is not an easy one, for the readjustments that will be necessary when that day comes will demand calm execution of a constructive plan which must be worked out long before the need for it arises. I am confident that out of the experience we gain in preparing our country for defense will come new and basic knowledge for such a plan and the wisdom to apply it for the economic security of all who value the right to earn our living as a free and happy people. The greatest danger of the moment is that the creature satisfactions of the artificial prosperity of defense production may lull us into a false sense of well-being. . . .

"To improve products and develop new ones requires research, a term that sometimes frightens people who do not take the trouble to investigate its true meaning. After all, research simply means providing for the future. Funds invested in research, whether it be a simple investigation or a complex, far-reaching basic study, are the best means of assuring progress in any technical field. Experience supports the statement that savings through research lead to prosperity by improvements in methods of manufacture and development of products that otherwise would never have been created. The company that is content to carry on as it always has are like the dweller in a valley who is too lazy or unimaginative to climb the hills to see what lies beyond. . . .

"At no time in the history of American industry has it been more important that research become part of the activity of every company. An enormous amount of research is now going on in the interests of national defense production and if we are to find a sound solution for the complex problems of the post-defense era, long-range research is vitally necessary. The question is not

whether a company can afford to do research, but whether it can afford not to. When the emergency has passed, industry will be faced with the task of finding a normal consumer market for its products to replace the government orders now being filled. Creation of this new market depends upon new and better products."

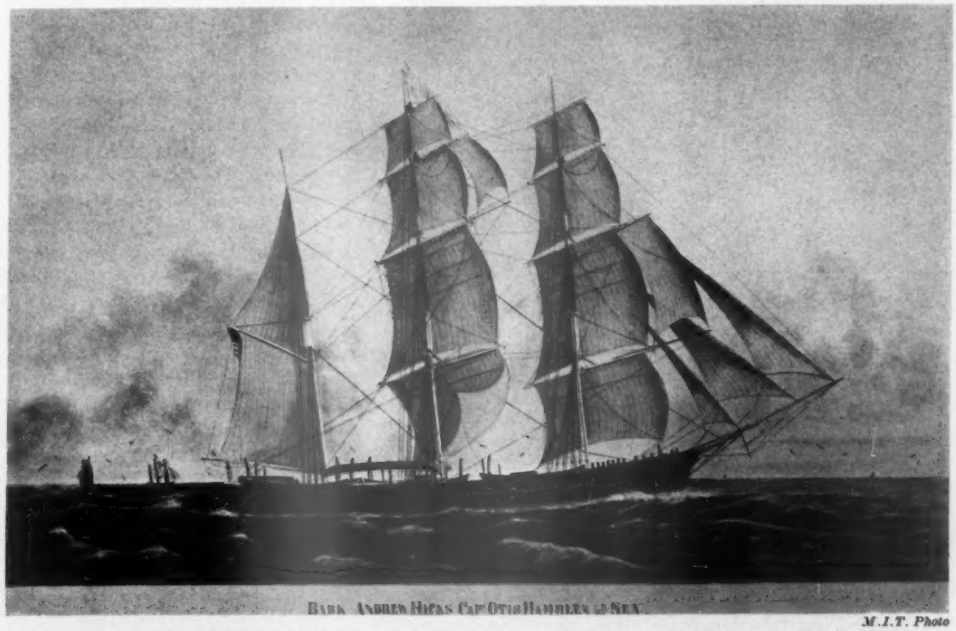
Six Historic Ships

AMONG the notable exhibits in the Francis Russell Hart Nautical Museum at the Institute are models of types of vessels associated with the discovery and settlement of the American continent. They are Leif Ericson's Norse trader, Christopher Columbus' *Santa Maria*, an English galleon of the Elizabethan era, Christopher Newport's *Susan Constant*, Henry Hudson's *Half Moon*, and Christopher Jones's *Mayflower*.

These fine models, all of which were built by James R. Jack, Professor Emeritus of Naval Architecture and Marine Engineering and Honorary Curator of the nautical museum, are now described in an interesting brochure in which Professor Jack comments upon their origins and their places in the early history of America. The models were built only after Professor Jack had done a great deal of painstaking research in this country and in England to determine the accuracy of the historical information on these vessels.

The model of the Norse trading ship follows the basic design of a group of early Scandinavian craft found in funeral mounds and now preserved in Oslo. These vessels were built considerably earlier than the time of Leif Ericson's voyage to Vinland, which is believed to have been the American continent, but as there was very little change in design in Scandinavian vessels in that period, Professor Jack believes that Leif's vessel was of approximately the same type. The Oslo ships are very fine in lines and were intended primarily for rowing rather than for open-ocean work. As Leif Ericson's ship was a trading vessel, Professor Jack believes that it was considerably fuller in the lines and a more seaworthy craft, though it probably retained the high stem and stern typical of Scandinavian vessels of that era. Her rudder, for instance, would be on the "steerboard," or starboard, side as in the Oslo boats. The rudder on the Institute's model is decorated with a cross, a symbol suggested by Leif's introduction of Christianity to Greenland, and the figurehead consists of a scroll pattern similar to that on one of the Oslo ships. This vessel is an open boat with only a short deck at each end, and has for protection at night a tilt, or tent, supported on crutches. The sails of some of the Viking ships were very decorative, but in a trading vessel, Professor Jack believes, they were probably rather simple, usually of vertical stripes of different colors.

In building the model of the *Santa Maria*, Professor Jack was handicapped by lack of data as well as by many inaccuracies in such information as exists. His model was based on one built in Spain, after a study of Columbus' diary, and exhibited in 1892 for the four-hundredth anniversary of Columbus' voyage. Later research indicated, however, that the model was far from correct historically and probably represented a type of about a century later. Professor Jack has undertaken construction of a new model of the *Santa Maria* which is based on the research of R. C. Anderson and will follow the lines of the model made under Anderson's supervision for the Addison Gallery at Phillips Academy, Andover, Mass. The data gathered in this research indicate that the *Santa Maria* was about 64 feet on the keel with a length from stem to stern of 81 feet, a beam



M.I.T. Photo

This ship portrait of a New Bedford whaler was painted by Benjamin Russell of New Bedford (1804–1885). Though no genuine artist, Russell was painstakingly accurate, and his many works are important in the pictorial history of whaling. He painted not only numerous ship portraits, which were fashionable in the homes of ship captains and shipowners, but also sketches for many of the authentic and well-known lithographs of the whaling scene. There are seventeen original Russell water colors, the largest single group in existence, in the collection of whaling prints presented to the Francis Russell Hart Nautical Museum by Allan Forbes, Jr. This collection was gathered by Allan Forbes, Sr., who personally contributed some of the Russells; a few other Russells in the seventeen were added by the State Street Trust Company.

of 27 feet, and a depth of 13½ feet. Professor Jack remarks in his discussion of this vessel that it is quite out of the question to reproduce an individual ship accurately and that it is best to be content with an illustration of the type of her time and of approximate dimensions. He adds that had the *Santa Maria* been returned to Spain, her fame would have ensured a record which today would be beyond price, but her loss on Christmas, 1492, on the island now known as Haiti has left many problems for students of nautical history.

While the model of the Elizabethan galleon represents no particular ship, it is included as a type which may have visited Virginia. The model represents the largest vessel in the fleet which defeated the Spanish Armada in 1588, an event which had a profound influence on the political and religious liberties of northern Europe, England, and Holland, and through them of the American Colonies. The design for the galleon model was drawn from information found in a book called *Fragments of Ancient English Shipwrightry*, one of a precious collection of naval material bequeathed by Samuel Pepys to Magdalene College, Cambridge, England.

Delgh-Navin

TO THE PRESIDENCY

. . . of the Alumni Association, B. Edwin Hutchinson, '09, has been named for election this year. Chairman of the finance committee of the Chrysler Corporation, of which he is also director and vice-president, the nominee selected by the National Nominating Committee of the Alumni Association for this spring's balloting has been a term member of the Corporation of the Institute since 1936. Mr. Hutchinson became vice-president and treasurer of the Chrysler Corporation in 1924 after extensive experience as a manufacturing engineer and executive. His chairmanship of the finance committee of that corporation began in 1935. A director of the Automobile Manufacturers Association, Mr. Hutchinson is a member of the Newcomen Society, the Princeton Engineering Society, the Detroit Engineering Society, the American Council on Foreign Relations, and the Society of Automotive Engineers, as well as of various clubs. He was Cyrus Fogg Brackett lecturer at Princeton in 1932.

A model of the *Susan Constant*, or *Sarah Constant*, is associated with the expedition which in 1606 followed Sir Walter Raleigh's earlier attempt to establish a colony in Virginia. Three small vessels brought the settlers to America, for in addition to the *Susan Constant* there were the *Goodspeed* and a pinnace called the *Discovery*. There is considerable doubt about the name of the largest of these vessels. Whether she was the *Susan* or the *Sarah* is still uncertain, and, too, there is evidence that her surname may have been *Content* or *Constance*. Only the name *Discovery* is agreed upon, for the second vessel may have been called the *Godspeed*.

Drawing upon the history of this early expedition and much subsequent research, and with the knowledge of tonnage rules of the period, Professor Jack was able to deduce the principal dimensions of the *Susan Constant*. Her rigging, in all probability, he says, was that of a three-masted ship with courses and topsails on the fore- and mainmast and lateen on the mizzen, as well as a spritsail below the bowsprit.

Professor Jack paid particular attention to the flag carried by this vessel, for, he writes: "Owing to the continued friction between his Scottish and English subjects at sea, the King (James I and VI) ordered all British vessels to fly a union flag at the mainmast head. In addition, the English vessel carried the red St. George's cross on a white field at the fore, and the Scots carried the St. Andrew's silver saltire on a blue field. This order came out on April 12, 1606, and as this expedition sailed in December of that year it must have been among the earliest to carry the Union Jack, which then consisted of the crosses of St. George and St. Andrew only."

Henry Hudson's *Half Moon* was a little ship of the type which the Dutch called a "yacht," although she in no way answered the description of a modern yacht. Her length from stem to sternpost is believed to have been about 63 feet, and she had a breadth of 18 feet and a depth of 10¾ feet. Incidentally, these measurements are in Amsterdam feet, one of which equals 11.18 inches of our measurement.

The model built by Professor Jack for the museum is based on the best available information and the flag at the fore is that of the city of Amsterdam, where the ship was registered. At her main she carries the flag of Holland — orange, white, and blue horizontal stripes — with the letters *V O C* representing Vereenigde Oostindishche Compagnie. At the mizzen is carried a similar flag without the initials, and the ensign at the stern is the flag of Holland charged with the arms of Amsterdam, which are repeated on the stern with supporting lions. The figurehead is the Dutch lion, which had been carried for many years in the Dutch navy. Professor Jack notes that the Dutch colors of that period, namely, orange, white, and blue are the colors of the present state flag of New York. They are arranged vertically in New York, while in Holland they were horizontal.

Many models of the historic *Mayflower* have been built, but very few have any claim to accuracy. In searching for information on which to make this model,

Kazanjian

NOMINATED

. . . for term membership on the Institute's Corporation. Selections by the National Nominating Committee of the Alumni Association this year are, from left to right, George J. Mead, '16, assistant to William S. Knudsen, director general of the Office of Production Management, Washington, D. C.; Robert E. Wilson, '16, President and director of the Pan American Petroleum and Transport Company and subsidiary companies, New York; and Edward Pennell Brooks, '17, Vice-President of Sears, Roebuck and Company, Chicago.

Professor Jack found that the known facts are her name; her tonnage, which was about nine score tons; and that she had topsails, since it was stated that a young man who fell overboard caught the topsail halyards, which were trailing over the ship's sides, and was saved. Beyond this, most is conjecture and a fruitful source of controversy. Although the model at the Institute was made before R. C. Anderson had undertaken a study of the history of the *Mayflower*, the fine model Professor Jack built corresponds fairly closely in sail plan and rigging to one based on Anderson's research. The Institute's model has the underwater portion painted green, as it was considered that by the time the ship arrived in America the bottom must have been well coated with seaweed. The topsides are brown to suggest a coating of pine tar, while the upper works are white, as some of these old ships were known to have been so painted.

Although her master's identity remains in doubt, there is evidence to suggest that the *Mayflower* was commanded by Captain Christopher Jones. What became of the *Mayflower* is a mystery, although Professor Jack notes that an attempt has been made to identify her timbers with those of an old barn in Buckinghamshire in England. While he agrees that some of those timbers came from an old ship, there is no proof whatever, he says, of their being from any particular ship, more especially from the *Mayflower*.

Elections Impend

BALLOTING to elect officers and representatives of the more than thirty thousand Alumni of Technology will be going on during the next few weeks. The slate of nominees for 1941 election has been prepared by the National Nominating Committee of the Alumni Association, comprising Ernest B. MacNaughton, '02; George M. Gadsby, '09; Charles R. Main, '09, chairman; Charles P. Fiske, '14; Walter J. Beadle, '17; Stanley W. Hyde, '17; Alfred W. Hough, '19; William J. Sherry, '21; Kenneth M. Cunningham, '22; and Franklin Fricker, '25.

For President of the Alumni Association, the nominee is B. Edwin Hutchinson, '09, III, Chrysler Corporation, Detroit; for Vice-President, Harold Bugbee, '20, XV, Walter B. Snow and Staff, Inc., Boston; for members of the Executive Committee, Herbert S. Cleverdon, '10, IV, Cleverdon, Varney and Pike, Boston; C. Yardley Chittick, '22, XV, Heard, Smith and Tennant, Boston.

Nominees for term membership on the Corporation of the Institute are George J. Mead, '16, II, Office of Production Management, Washington, D. C.; Robert E. Wilson, '16, X, Pan American Petroleum and Transport Company, New York; and Edward Pennell Brooks, '17, XV, Sears, Roebuck and Company, Chicago.

To succeed Messrs. Sherry, Gadsby, and MacNaughton as representatives of Districts 8, 9, and 10, respectively, on the National Nominating Committee, one member for each district will be elected from the following nominees: *District 8:* Charles A. Smith, '99, I, Georgia Power Company, Atlanta, Ga.; Thomas C. Keeling, '07, VI, Nashville Machine and Supply Company, Nashville, Tenn.; Arthur E. Hartwell, '09, II, Hartwell Iron Works, Houston, Texas; *District 9:* Charles F. Willis, '06, III, *Mining Journal*, Phoenix, Ariz.; Harry A. Rapelye, '08, II, Continental Can Company, Inc., Kansas City, Mo.; Winter Dean, '21, XV, Nicols, Dean and Gregg, St. Paul, Minn.; *District 10:* Joseph Daniels, '05, III, University of Washington, Seattle, Wash.; John C. Kinnear, '07, III, Nevada Consolidated Copper Corporation, McGill, Nev.; Edward E. Scofield, '19, VI, Washington Water Power Company, Spokane, Wash. Members of this Committee are elected by districts so staggered that three or four members relinquish their work each year.

Industrial Economics

RECOGNIZING the fact that after the war the nation will be confronted with problems of readjustment and reconstruction which in many respects will be more difficult than the problems created by war itself, the Institute next autumn will start a graduate program of research and instruction on economic and labor problems of industry, a program leading to the degree of doctor of philosophy in industrial economics.

Outlining the type of problems on which graduate students may work in different industries under the supervision of members of the Faculty, Professor Ralph E. Freeman, Head of the Deaprtment of Economics and Social Science, emphasized the need for long-range planning for peacetime conversion of plants and use of excess capacity in various industries now engaged in producing war products. He also spoke of the eventual absorption into industry of men in the Army and of how workers in defense industries can be redistributed. There is need for study, he said, of maintaining the impetus that the defense program is giving to technological invention and of improvement to create a higher standard of living in the postwar period. He added that in studying methods of assisting industry to make the eventual transition to peacetime operation and normal production, historical material and the mistakes of the past should be taken into consideration.

While the new program in industrial economics at the Institute does not propose to study these problems to the exclusion of the more immediate defense projects, Professor Freeman emphasized the need for constructive thinking on future readjustments. He said that several members of the staff of his Department are already engaged in governmental work on current problems.

In recent years the Institute has brought to its staff a number of authorities in the various fields to be covered, and this group will have the co-operation of the teaching staff in the scientific and engineering Departments, who will assist in seminars in industrial technology. Students will also have the benefit of close association with the work of the Department of Business and Engineering Administration in related studies of business management, and the help of the advanced work that has been done in the field of industrial statistics. The fundamental work of the Industrial Relations Section of the Department of Economics and Social Science is expected to be of special value in the projected Course.

This new branch of professional training is expected to fit graduate students for careers as teachers, research specialists, and industrial consultants in a broad field of industrial activity in which they will bring together the technical information of industry possessed by the engineer and industrialist and the knowledge, in both its theoretical and practical aspects, of the economist. The new Course is expected to enlarge the sphere of economists, who are already sought by industrial enterprises, banks, trade associations, and labor organizations. There is also a growing demand for adequately trained men in the various governmental administrative agencies concerned with industrial relations.

In announcing the Course, which requires a preparation including a bachelor of science or a bachelor of arts degree from a university of recognized standing, Professor Freeman said that fellowships up to $1,200 a year will be available to specially qualified students in the new Course.

Louis J. Gillespie, 1886–1941

LOUIS J. GILLESPIE, Professor of Physical Chemistry in the Institute's Department of Chemistry, who had been a member of the staff since 1920, died on January 24. Before coming to the Institute he had considerable experience in teaching, bacteriological investigations, and research in soils and plant industry for the United States Department of Agriculture.

Professor Gillespie was born in Hillsboro Bridge, N. H., in 1886. In 1908 he was graduated from Brown University, which awarded him his doctorate in 1911. For the following three years he was a fellow in bacteriology at the Rockefeller Institute for Medical Research and a bacteriologist for the board of health of New York City. Professor Gillespie was the author of *Physical Chemistry* and of numerous articles in professional journals.

Fellowships

THE fourth national competition for a group of ten fellowships permitting participation in a one-year co-operative program of executive development in business administration and economics at the Institute was announced recently by President Compton. At the same time he disclosed a new grant of funds by the Alfred P. Sloan Foundation, Inc., of New York, to be used for stipends to aid those successful in the competition.

This is a distinctly co-operative program in which the Sloan Foundation, the Institute, and many individual companies are making significant contributions. The common goal is the development of leaders with an understanding of the broader and longer-term phases of management and of the complex economic and social environment in which modern business operates. With the completion next June of the tenth year of its operation, seventy men will have benefited from this training and returned to the companies from which they had leaves of absence. Many of these men, in spite of the brief lapse of time since completion of their work, are filling responsible executive positions, not a few in important defense industries. During the past three years over 275 well-known companies in all parts of the country have nominated almost five hundred candidates for these competitive fellowships, which are directed by Professor Wyman P. Fiske. Important current defense problems and inevitable postwar adjustments make even greater the long-range responsibility of industry to develop from its ranks leaders capable of meeting the problems ahead.

The competition, which closes on March 12, is open only to men in industry of the ages of from twenty-seven to thirty-three, who have by their progress demonstrated unusual promise of further advancement in responsibility. Leave of (*Concluded on page 230*)

"Dad, why do they put it under the street?"

"Because, Son, in a big city like this there isn't room *in* the streets for enough poles to carry all the telephone lines needed."

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THE TREND OF AFFAIRS

(*Concluded from page 197*)

in the Charleston Navy Yard, and pressures as high as 1,700 pounds a square inch in Europe. The storage tank is insulated to minimize heat losses, and useful energy is stored in the water, in the steam, and in the surrounding metal. Since water normally fills about two-thirds of the tank, most of the energy is in the water rather than in the steam above it. In the highest-pressure locomotives, the metal parts have been estimated to store about one-fourth of the useful energy by virtue of their elevated temperature. When the engine is in operation, it draws steam from the tank; the pressure in the tank is thereby lowered and the water gives off more steam as a result of renewed boiling.

With low-pressure steam, about fifteen minutes are required to charge the locomotive for three hours of freight-switching service. In a typical high-pressure locomotive, one ton of steam at 1,700 pounds a square inch will pull a 400-ton train for more than six miles. An engine of this type has been regularly used in Europe to shuttle 1,500-ton coal trains on a one-mile siding between a railroad and a gasworks, at less than half the fuel cost for a direct-fired steam locomotive. On downhill runs, the engine may be operated as a compressor to provide braking action, either sending the compressed air into a storage tank or returning the air to the atmosphere through a valve.

The fireless locomotive in the Charleston Navy Yard is given two full steam charges and two partial charges during an eight-hour day, according to W. Mack Angas, '17, writing in the *Scientific American*. Steam pressure in this locomotive has usually been 160 pounds a square inch, but tests which have been made at 400 pounds a square inch show that a single charge at that pressure can provide amply for four hours of normal service.

In view of its well-defined advantages and limitations, the fireless steam locomotive appears qualified to take its place in the field of modern commercial transportation.

SIR THOMAS GRESHAM'S PICTURE

(*Continued from page 200*)

as Wren himself did with St. Paul's. In our own land, committees are actually spending time on plans to protect our historic shrines if the black-outs happen here. When sentimental reconstructions appear, regardless of whether they bear long-time animosities — as the famous Warren inscription for Louvain — they inevitably tend to congeal the city plan in the old form. For historic foci of sentiment, though of no present importance and therefore permissibly out of the way, are dramatic, bearing a whole series of contexts hard to forget. Though the fires may be scanted by historians, the things they destroy are vaunted.

The original sites of cities, moreover, were chosen either because they offered a natural means of defense or because commerce gathered men at the point. There are perhaps no longer any natural points of defense, but if there be, they are probably very different from those which caused the earlier site selection; and rivers, usually obsolete as channels of commerce, constitute today the one unfailing guide for the hostile bombing plane. Hence good reasons may be adduced to show why a given city should not be rebuilt at all or should be located on some different site. At this moment the sentimentalists give tongue.

But the chorus of the softhearted seldom prevails unless to it is added the bay of the hardheaded. If I own the property adjacent to Times Square and all Manhattan is flattened to the ground, in the rebuilt city my property is unlikely to have as high a value relative to the whole, for the new plan is unlikely to lay as much importance on my area. It will be strange indeed, under such circumstances, if I do not agree with the members of the Society for Preventing Times Square from Becoming a Byre. Sentiment and private landownership fighting shoulder to shoulder have thus far been impregnable. Private landownership alone can put up a respectable fight. Profit of course is but the most vigorous of a whole series of motives which might cause men to block civic progress. Chambers of commerce and public housers are as town and gown; on the few occasions when the former have actively led movements for betterment, the latter have sometimes been in opposition. Serious Federal research in housing has been obstructed more than once by the conflicting ambitions of antagonistic department heads.

As has been suggested, however, there are psychological differences between the civic disasters of the past and those of today, as well as differences in scale. Finally, other major factors raise a hope that this time things will work themselves out differently, even though one very big assumption underlies all such speculation. The assumption is that when the battle is over, planners — our planners — will have something to say about what is done. But if we cannot make that assumption, discussion is profitless. Two major problems are posed. One is already set; the second cannot arise vigorously before the armistice.

Dramatically demonstrated in Finland, the first and present problem is the emergency demand that housing be provided for a very large proportion of a population, and at once. In Finland, a half million people are involved; the comparable number in the United States, for example, would be at least sixteen million. When urgency such as this exists, there can be no question of maintaining the old standards. The only realistic course, as Alvar Aalto has pointed out, is to get roof and walls up for the dispossessed, and to get them up at once. The shelter thus provided must average near the optimum possible under the conditions, for it is intolerable that any one family shall be rehoused at a standard so far above average that some other must fall seriously below. The lower degree of shelter would be uninhabitable. This problem has been solved variously in various times, never better perhaps than by our own Red Cross. But in its previous appearances, the problem has been faced fundamentally, even completely, as an emergency matter. In the present rehousing of Europe another factor appears.

(*Continued on page 222*)

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SIR THOMAS GRESHAM'S PICTURE

(*Continued from page 220*)

Because of the virtual impossibility of erecting a building which will wear out when we want it to, emergency housing programs contain grave dangers. When urgency must be faced, as in Finland, it is impossible to plan towns in such a way as to insure that the permanent-temporary buildings, once erected, shall not later on lay a blighting hand on every effort of the planner who would gradually bring the people back to their former standard. Aalto has therefore proposed in his studies for Finland an ingenious and thoughtful alternative. It consists of so building the crude temporary shelters that they can later in various ways be converted into houses of higher standard and so moved on the terrain that the town plans can in turn be improved to the necessary higher level.

On page 198 is sketched his proposal for the very simplest of these shelters, one which is planned to be removed entirely, as a tent might be removed, and which he therefore names "transportable primitive shelter." These little units, each of which provides nothing more than two bunks on which to sleep, can be nested for transit and assembled in various relations around a central stove. Another proposal for a "transportable primitive shelter" provides four movable rooms which in the first instance will house eight people around a central heating unit, somewhat regardless of family considerations; such a shelter may later be adapted to form a simple one-family dwelling such as would be acceptable in rural areas.

A second arrangement, for "ready shelter," which at the beginning provides housing for three families, subsequently will become housing for one. In his schemes for "temporary shelter" Aalto has provided for the future town plan with buildings which at the outset serve seven families and later are broken apart to house two families, with adequate open space between the two houses. In his "embryo shelters" he provides for the growing type of accommodation, starting here always from the single family unit.

Aalto has pursued these studies seriously. He has developed many types, carefully considered as to space accommodations, designed in accordance with the materials and labor which may be available for his own land. Direct application of the arrangements to other places — to China, to Britain, even to disaster areas of our own land — can be made only in principle. Similar realistic local consideration must be given. Finally, as in any other form of planning, the whole scheme falls to the ground unless it is supported by those who would build — by government where government has the problem, by relief agencies where they have it, by industry if the question rests there. But the idea is thoughtful, it is worth careful consideration and development, and it involves the sort of thinking in which the planner can now profitably indulge.

Such thinking naturally covers only the most urgent problem of rehousing homeless populations. It takes no consideration of what is to be done about whole cities which have in effect been wiped from the map. Their people may be rehoused somewhere and by methods proposed by Aalto. Immediately thereafter, the general question of re-employment arises. Other types of reconstruction must occur: first, clearly, industrial reconstruction, because life cannot go on without work; only after this problem is well solved can the luxury of amenity reconstruction be enjoyed — the rebuilding of spiritual and physical recreation centers, for example.

At this point we must consider what these cities shall be. Before we do so, we might consider whether they can possibly be what they should be. Will Sir Thomas Gresham still peer down?

Countless efforts have been made by well-meaning planners of the past to assemble neighborhood properties for a common goal. Many workable methods have been proposed, including the admirable Lex Adickes, which in effect established for each owner an equity in a common ownership, proportional to the value of his piece when he owned it privately. None of these schemes has worked with great success under ordinary stimuli.

But Britain, for example, is under more than ordinary stimuli. The people of every nation now appreciate that in total war all must contribute for all. If through enemy bombing my son is killed and yours is not, I have the consolation, for what it is worth, that my son will be called a hero. If, however, my building is gone and yours is not, the inescapable fact is that there is nothing heroic about lost money. The bombing of London is in a very real sense an attack on the institution of private real property. Britain has recognized the difficulty and set about nationalizing her insurance. In this undertaking lie mechanisms for rearranging property ownership after the battle: restoring it to the state, if desirable; dividing it on an equity basis, as in the Lex Adickes; or setting up some other substitute for restoring it in its small original parcels to the original owners.

Again, urban catastrophes of the past have been personal. While Chicago burned, St. Louis made hay. The competing city had to get back on its feet, and soon. When a nation lies in ruins, the situation may be different. A forward-thinking group in city A might well say: "Let the ambitious men of city B rapidly rebuild on their ruins, perpetuate the values of the past, even the bad values. Let them gain whatever temporary advantage there may be. We will proceed with more care. We will consider where the town should be; know what it should do and hence how it can best do its work. In the long run, we shall triumph." This type of thinking will be possible as never before.

Other factors may play their part. More and more people have more and more knowledge about more and more possible improvements. An infinitely greater popular demand for proper planning may be expected than could have been possible even in San Francisco in 1906. The British are already speculating thereon. Among their observations are such as these:

> The present war may in one particular well hasten on what is already happening. Ferro-concrete will come still more into its own. . . . The desire to dissociate oneself from the bad old past, which led to such catastrophes as the present war, may well lead farther in that direction. . . . Anyone who has seen the indecent state of some buildings in London at the present moment . . . will (*Continued on page 224*)

"Ma Says It Tastes of Coal Oil!"

MA IS probably right. The clerk who had to fit shoes and horse collars, measure out nails and putty, and draw kerosene couldn't always stop to wash his hands before he handled the butter and crackers. And every so often the potato on the spout of the oil can would joggle off.

Today, for most of us, the mixture of food and kerosene odor has ceased to be a problem. More and more of our food, packed by electric machines, comes to us in sanitary containers. Electricity does the work, too, of washboard and carpet beater. Automobiles and good roads have shortened distances to town and work. And because so many of the routine, unpleasant jobs which occupied our parents' time are now only memories, we have more opportunities for enjoying life to the full.

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SIR THOMAS GRESHAM'S PICTURE

(*Continued from page 222*)

in future want an architecture sufficiently truthful throughout not only to live decently and unpretentiously but to die decently as well. . . . It is the monumental shams with which during the last thirty years we have been lining the chief streets of our cities which are now disgracing us. . . . The ideal way would seem to be for each big city first of all to acquire the land and buildings within its boundaries and then to lease the buildings it wished to keep standing. Then, and only then, would the authorities feel free not only to clear great areas, but perhaps not to rebuild them at all.

Moreover, the 1940 Council to Promote the Planning of Social Environment has been formed, under the chairmanship of Lord Balfour of Burleigh; more official still, Thomas S. Tait is director of standardization for the Ministry of Works and Buildings, and his department has undertaken the formulation of a large reconstruction plan affecting England.

More than raising new buildings is here involved. Coventry, for instance, must consider not only its new street layouts but the question of whether it should again make bicycles; it must consider whether it shall make anything; indeed, whether it shall even continue to exist.

The industrial revolution may well be over; industrial evolution we shall constantly have with us. Consideration hence must be given to the question of what role England shall play in a new world in which she is victor. Shall she be base and frontier for a great English-speaking union? Shall she be fortress; or manufacturing center; or shall she revert to agriculture? If she remains industrial, shall she stick to the trades which first made her great? These questions must be answered before the role of each new city can be determined. It cannot profit a nation which has learned as much about co-operation as Britain has in the past months, lightly to cast the lesson aside when disaster ceases to threaten. Co-operation may be even more necessary in peace than in war.

The evolution of industry and economy is unnaturally accelerated by war. Plans made during the period of war for rebuilding devastated areas must therefore seek as far as they can to anticipate the needs and changes which will evolve into full being in the years after the cessation of hostilities.

Over all cogitations will hang the shadow of the bomber. The tendency in the present dark moment is to say that no replanning is worth thinking about unless a saner world is to exist. The world, however, has never been sane, and the city of the future cannot ignore the bomber. Human nature will not undergo a permanent change; men of bad will cannot be driven from the earth and the sky; the probabilities are that bombs and bombers will become increasingly efficient.

Defense may conceivably so overtake attack that the bombing of civilians from the skies will become unprofitable. But to plan that way is not safe. The future cities of those who are to survive must deal with the bomber. In this requirement is nothing fundamentally impossible. The exact methods are obviously still the subject more of speculation than of confident knowledge. To the extent that they require more material than

did former buildings, the new requirements will lay a heavy responsibility on a building industry which in its best days has never met its full social responsibility.

The solution to the problem of replanning whole cities is of course very difficult; may be in the greatest sense impossible, beyond the capacities of man to plan, beyond the capacities of men to co-operate to achieve. But to accomplish something important is still possible. To do so demands very close study of postwar national and regional needs. It means a government strong enough and of sufficient good will to do the necessary. It means that the planners must be very close indeed to that government and on hand now, so that when the great flood of rebuilding commences, it can proceed in accordance with an ordered program. The program for tomorrow must be under constant change because of the events of a tumultuous today; if the planners sit remotely in universities or at journalists' desks or tucked away in minor capacities in a hundred bureaus, out of the stream of events, deprived of contemporary information, their results will be unrealistic, useless. It is imperative that these later plans be not the creation of a four days' charette à la Wren.

It is also essential that the rest of society take the plans seriously. Cities have for the past thirty years undergone a spectacular breakdown. The physical destruction offers opportunity for wholesome reconstruction. If this is not done, we may all too soon return, and once and for all, to the state described by Hobbes, with "no arts, no letters, no society, and, which is worst of all, continual fear and danger of violent death, and the life of man solitary, poor, nasty, brutish, and short."

COAL AND THE WEST

(*Continued from page 203*)

it has not replaced coal to that extent. For certain uses, of course, petroleum and natural gas are directly competitive with coal, the shift of about half the world's seagoing tonnage to oil being such an application, although in absolute terms the loss is not large. More important is the oil consumed by locomotives, power plants, and homes. Most oil products, however, are burned in automobile and airplane engines, competing with coal only to the extent that autos and planes take traffic away from railroads and urban transit lines. Neither is the natural gas consumed in making carbon black a hindrance to coal production. All in all, not much more than half of the crude oil and gas used every year can be considered as displacing coal, so that, at a fair guess, oil production has probably subtracted less than 1 per cent from the rate of growth of coal output.

The explanation most commonly put forth as the major cause of coal's decline is increased efficiency. In Great Britain, it is pointed out, the amount of coal necessary to generate a unit of electricity has been cut nearly in half in the last twenty-five years, and (*Continued on page 226*)

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COAL AND THE WEST

(*Continued from page 225*)

the output of gas per ton of coal has risen 30 per cent in the same time. In this country, a 31 per cent reduction has occurred in the coal required to do a given amount of work in a freight locomotive, a 19 per cent reduction in the amount of coal necessary to produce a ton of pig iron, and so on. To see the efficiency argument in its proper perspective, however, it must be remembered that increasing efficiency has always been a characteristic of this engineering age. The greatest percentage saving in coal consumption probably came not in the Twentieth Century but in 1769, when Watt patented a steam engine with two times the efficiency of the Newcomen type. There was also, as Bone and Himus describe it, the "epoch-making invention of hot blast in iron smelting by James Beaumont Neilson in the years 1828 to 1832, which also signalised the beginning of modern fuel economy generally." Nineteenth Century engineers were efficiency minded, used insulation, and had a pretty fair knowledge of the laws of heat flow; yet in spite of these facts coal consumption went bounding upward at an annual rate of 4 per cent or more. Even granting that attempts to increase efficiency have been more effective during the past quarter century than at any other period, they still do not explain why the rate of growth for coal changed from a plus to a minus.

Had the pre-World War rate of 4.4 per cent a year been continued, the world would be producing today some four thousand million tons of coal, over three times as much as its actual output. Neither water power, petroleum, nor increases in efficiency can account for the discrepancy.

The basic reason for coal's present course — and the theory checks too well with such indications as lessened per capita production (previous to the war boom) and flattened population curves for it to be ignored — is that the industrial civilization of Europe and America has reached either a temporary plateau or a permanent one, i.e., has reached maturity. Whether this cessation of growth is that imposed by the first World War and its aftermaths and thus is similar to the early maturity of a slum dweller, or whether the cessation is merely a pause before the start of a newer and braver world is hard to say. Some slackening in the pace of expansion could almost have been anticipated, for the natural procedure for new inventions and industries, and perhaps for the new civilization they have created, is to experiment gingerly with their possibilities, to grow rapidly as these possibilities are mastered, to taper off into a relatively long period of refinements and stability, and eventually either to decline or to move rapidly forward in the wake of a major new invention. The railroads appear to have passed into a static phase; with the advent of the fluorescent light a similar fate threatens the incandescent lamp. If, as Spengler prophesied on quite other grounds, this mechanical age were to follow the same development pattern as a mechanism, we should face a prince among ironies.

But the threat of large-scale retreat from the standards of this era seems still far away. The immediate danger is that, when the war ends, the nations will be

faced with the task of reknitting the fibers not of youthful and growing structures but of societies which have apparently lost the habit of rapid physical expansion. There is no doubt, for example, about the material capacity of France to replace, and rapidly, the buildings and equipment she has lost. The tremendous productive ability of present technology makes that achievement quite feasible. Nor is there much need for speculation about the dubious advantages of a world production based on the utilization of four thousand million tons of coal a year. We have managed fairly well with a relatively static level of energy consumption, for in replacing a worn-out automobile by a slightly better one, a lathe by a more rigid lathe, a pair of silk stockings by a pair of nylon, there is full opportunity for improvements in performance and for savings in cost — for a rising standard of living or, in broader terms, a stronger economy. What is most to be feared, however, is that the loss of momentum should reflect some deep-seated social confusion, some change in the ultimate motivating forces of this civilization. Without doubting the power of the West to recover, we must recognize that for many years the portents have indicated a slowing down of its grosser life processes.

THE HUMANITIES AT TECHNOLOGY

(*Continued from page 212*)

founder and has emphasized continuously the broader aims of a general education even within the framework of professional Courses themselves.

Occasionally there has been a discordant note. Some have felt that the work of the Institute should be strictly scientific and technical, and that the effort to seek a general education, especially in an undergraduate institution, is fruitless and discouraging. In his last annual report, in 1907, in a section entitled "Cultural Studies in Technical Schools," President Henry S. Pritchett struck a pessimistic note. "Twenty years ago," he said, "schools of technology were criticized on the ground that they taught men to make a living rather than to live. In response to this criticism, many schools of applied sciences — of which the Institute was a leader — have added to their courses of study a growing amount of so-called 'culture' studies. I think I express the opinion of many teachers in saying that the result has not been all that might be hoped for."

Pritchett believed that any Course, for example chemistry or physics, could be taught in such a way as to develop great humanistic interests as effectively as any of the so-called cultural subjects. From between the lines of his report we gather that he thought that each student should specialize very definitely in a single field of intellectual endeavor and that the broader culture which life so evidently requires could be secured not from the subject matter taught but from the personality of an inspiring and carefully chosen teacher.

In his educational philosophy Pritchett thus emphasized the teacher rather than the subject and evidently believed that the policy of the Institute in providing a wide variety of nonscientific subjects was bound to prove disappointing. All the other leaders of the Institute, however, as far as one can judge from (*Concluded on page 228*)

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THE HUMANITIES AT TECHNOLOGY

(*Concluded from page 227*)

their published reports, have continued to advocate the double aspect of educational life at the Institute and have felt that the study of the natural sciences and of engineering subjects should be broadened by contacts with great books and great ideas in the humanistic and social fields. This point of view, so frequently urged by President Rogers at the beginning, has been emphasized by succeeding Presidents and, with the full approval of the Alumni, has been a central feature of the policy of President Compton in recent years. This tendency was especially marked by the appointment, in 1937, of Edwin S. Burdell, '20, as the first dean of humanities.

In the meantime the need for humanistic emphasis has been widely felt throughout the country, not only in engineering institutions but almost equally in arts colleges, which have been subject to the same excessive tendency toward undergraduate work which has sometimes become unduly specialized, vocational, and technical. A recent study reveals that during the past twelve years at least thirty humanities courses by name have appeared in American colleges. More are announced. Twenty years ago there was none.

All this would seem to indicate that, at long last, the wise old founder of M.I.T. has established his claim to prophetic insight, and that in two directions: by his emphasis on the cultural value of scientific study, and by his insistence that the natural sciences need to be supplemented and enriched by historical, literary, and philosophical contacts.

Thus in seventy-five exciting years, in which more changes have taken place than ever before in a similar period in the history of education, the old and respected name of the humanities, like that of the humanist, has been modified and extended to include not only courses in literature but courses in the arts, philosophy, and history; and in numerous institutions these courses are now offered, as they have been for so long at Technology, from a fresh point of view, to emphasize the essential unity of the human spirit and the need for a new appreciation of human values.

With all that has been done, the task of fitting the broader purposes of education into a scientific framework is not always easy. Both the time and the interest of engineering students are today more than ever fully occupied by their professional pursuits. The solution of this problem may perhaps lie not in the abandonment of early objectives but in some method by which more time may be found without undue extension of the period now given to professional education. President Walker in 1890 believed that the time would soon come when certain students would desire to give five years instead of four to their engineering education in order to find time for essential subjects which were otherwise crowded out. In 1891 he suggested one feasible solution: "I have . . . expressed the hope that the excellent facilities here offered for historical, political, and philosophical study will, in a near future, induce very many of our students, including our best scholars, to extend their courses to five years."

The careful plan which he formulated in this direction was made impracticable by the severe financial depression which began in 1892, and was laid aside until it was taken up by President Maclaurin, who also believed that many students might be found who would be willing to give five years to a course which might combine a sound engineering and a liberal education. American entrance into the World War in 1917 and the premature death of President Maclaurin made it impossible to carry into effect the five-year program which he foresaw.

Whatever detailed solutions may be found, the educational tide is now running strong and deep. The new definition of the humanities and the renewed emphasis on spiritual values in the widest sense, under the leadership of such educational statesmen as President Conant at Harvard, President Hutchins at Chicago, and President Compton at M.I.T. in the field of scientific and technical education, are symptoms of deeper forces which are now awakening; and the revival of the humanities is an added proof of the ever renewed idealism of the American people. For though the humanities are always tools as well as means to culture, they are especially needed today in a world which must realize once more that it can no longer live by bread alone.

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THE WORTH OF THE INITIATIVE

(*Concluded from page 209*)

mission, to realize some great dream, to organize life in accordance with some dominating principle. Accomplishment of such aims means taking a positive line, not merely making a defensive stand; it means taking the risks that go with a positive line, not seeking the security deemed to lie in a defensive position.

If you take risks, among them must assuredly be the risk of war. But if you make your will firm to realize your principle, if you mobilize your power to achieve your dream, you will be so strong that men will hesitate to issue the final challenge that involves war. And if they be so mad, you may live in confidence that the power you have generated, the force you represent, the ideas and the ideals which move you are stronger than those of the challenger. Recent years have shown again that the weak foreign policy of appeasement brings war, whereas the strong foreign policy of fulfillment may avoid it. Consequently, peace is seen at last to rest upon strength and courage and faith, upon clarity of mind and firmness of will; but never upon doubt or defeat, hesitation or fumbling, the defensive spirit.

The central task for Americans is an objective definition of our interests and our responsibilities, of a shape of things to come which would enlist our energies and our resources. Then, if war comes, we would fight not to "defend" something but to *achieve* something. Of course, by influence and strength we might without war achieve that positive goal, imposing it upon an exhausted world by moral and economic and intellectual force. Statesmanship consists in dealing with events at hand with the means available in order to achieve long-matured, positive goals.

HOUSEWIFE AND ART

(*Continued from page 206*)

have not been improved by the superimposition of streamline skirts whose greatest use seems to be to spoil the tempers of oilers and enginemen and to achieve a less careful upkeep. These skirts will be of great use when trains start operating at double their present speeds. Then we shall have to give up our devotion to detail and be content to see the whole form wiggle around curves and over grades.

Compare a Finnish hunting knife with the streamline kitchen variety. Compare a whole row of things which may be found in any modern home — all of them of similar shape but each of differing function — with some antiques. Compare an English bicycle with its emphasis on lightness — a dear thing to the serious cyclist — with the streamline American variety, heavy with gadgets, misshapen like a Surrealistic painting, ponderous and ugly. For what purpose is the false funnel of a modern liner except to house the kennel?

Establishment of this principle of visual functioning presents a great opportunity for complete reform in the training of young men and women who are to become designers. Here is the opportunity to give the public a weapon against the scoffer who (*Concluded on page 230*)

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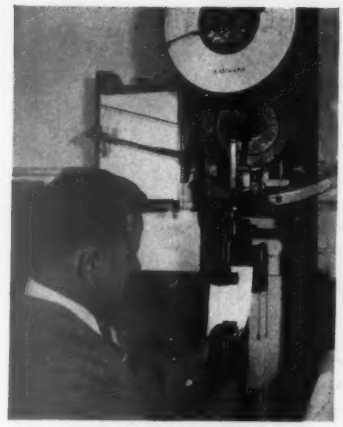

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HOUSEWIFE AND ART

(*Concluded from page 229*)

laughs at the statement "I know what I like"; for what he likes is the only criterion that any man can have. We must show student designers that their natural interest in function is admirable; that the more they understand of the functioning of an object, the better they will design that object. We must not inhibit their natural desire to seek truth as well as beauty in their creations. The student must be more craftsman, more engineer. In order to produce an industrial designer, it is far better to take a man who has a talent for making beautiful things and train him as a machinist, than to take an art student and put him in the shop. Unless a man is master of his material, he cannot create in it. Some hardheaded practical man, with no more eye for beauty than a goat, can always tell him, "You can't do that; it won't work." It is far better to take a lad who has a strong love for construction and a feeling for beauty and make a master builder out of him, than to allow the building profession to receive its designs from untalented men who have had all the training that our architectural schools can pour into them. The architect — and by architect is meant the originator of building ideas — must be talented if he is to produce great architecture; he must be a master of building, its planning, its structure, its materials, and its forms. Give the talented man more knowledge of the practical side of his profession, instill in him the love for that lean beauty which has been described herein, and the chances are that finer designs, more popular products, a greater and more enduring art, will come from his hand and mind.

THE INSTITUTE GAZETTE

(*Concluded from page 218*)

absence from present employment is a requirement. Candidates must also, normally by an adequate academic training in science or engineering, show evidence of ability to profit by a program of graduate level. Financial grants will be regulated by the recipient's income, but will not (for a married man) be less than $2,100 nor more than $2,500. Final awards will be made only after interviews with a selected group and will be based upon evidence of ability and opportunity to benefit from the special nature of the work.

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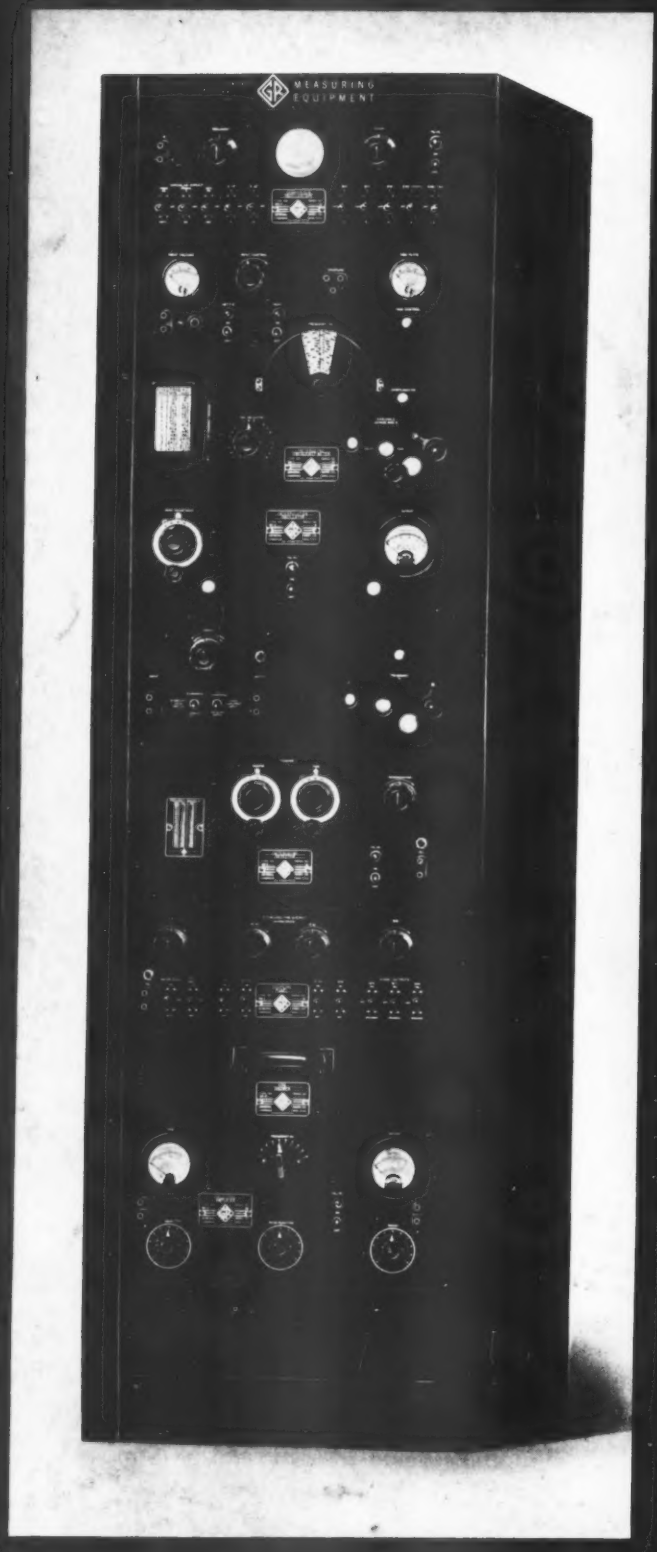

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